

RFI REPORT – FINAL REV 1
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■ ■ ■ ■ ■ **RCRA FACILITY INVESTIGATION**
U.S. DEPARTMENT OF TRANSPORTATION
HEADQUARTERS SITE
SOUTHEAST FEDERAL CENTER
WASHINGTON, DC



VOLUME 1 OF 4

prepared for



U.S. General Services Administration
National Capital Region
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Executive Summary

BACKGROUND

On behalf of the U.S. General Services Administration National Capital Region (GSA-NCR) URS Group, Inc. (URS) conducted a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for an 11-acre parcel of property within the Southeast Federal Center (SEFC). The 11-acre parcel studied is the location of the new U.S. Department of Transportation Headquarters (DOT Parcel).

The RFI was conducted in accordance with the U.S. Environmental Protection Agency Region III (USEPA) Final Administrative Order on Consent (CO), Docket Number RCRA-III-019AM, dated August 2, 1999. Beginning in September 1999, URS prepared site history and workplan documents required in the CO on behalf of the GSA-NCR. On September 13, 2001 the USEPA conditionally accepted and approved the documents, provided the nine comments attached to their approval letter were addressed to the satisfaction of the USEPA. The documents conditionally approved by the USEPA form the basis of the RFI conducted on the subject property.

The objective of the RFI is the protection of human health and the environment through implementation of the USEPA approved RFI Workplan for the DOT Parcel. Successfully fulfilling this objective is achieved through performance of:

- Interim Measures and Site Stabilizations (IM/SS) to remove threats to human health and/or the environment, and
- The RFI to assess the nature and extent of harmful constituents that may be present and assess the risk they may pose to human health and/or the environment.

This report discusses the results of performing the RFI for the DOT Parcel. Descriptions of the voluntary IM/SS activities already undertaken by the GSA-NCR and a detailed description of the history of the DOT Parcel are included in the companion document entitled "Description of Current Conditions and Summary of Interim Measures/Site Stabilization."

CURRENT SITE SOILS QUALITY

Of the 11 metals detected above soil Applicable or Relevant and Appropriate Requirements (ARARs), Aluminum, Arsenic, Barium, Chromium, Iron, Manganese, Nickel, Selenium, Silver, Thallium, and Vanadium, only three (Nickel, Silver, and Vanadium) are considered to be present as a result of human activity. Soils containing the Nickel and Silver exceedances will be removed as a result of constructing the DOT Headquarters building and the one location containing the Vanadium exceedance will be separated from the environment by being covered with new roadways and sidewalks. The Aluminum, Arsenic, Barium, Chromium, Iron, Manganese, Selenium, and Thallium exceedances were both present in soils attributable to human activity (fill material) and in soils deposited prior to human existence (terrace and Potomac Group deposits). Therefore, they have been ascribed as being indicative of natural variations in site soils.

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Only seven chemicals that are constituents of industrial solvents and vehicle fuels, Acetone, Acetonitrile, Benzene, 1,4-Dichlorobenzene, Ethylbenzene, Methylene Chloride, 1,1,1,2-Tetrachloroethane, and Toluene are present in soils above ARARs. The Benzene, Ethylbenzene, and Toluene are most likely the result of releases from former underground storage tanks (USTs). Benzene exceedances are present within the historic groundwater petroleum hydrocarbon plume that emanated from an offsite source. A limited area of similar-type soil impact, but isolated from the large groundwater plume area, was revealed and defined in the northwestern corner of the DOT Parcel. The 1,1,1,2-Tetrachloroethane exceedance is at one location and is likely the result of past vehicle maintenance activities once conducted on the DOT Parcel. 1,4-Dichlorobenzene was detected at the only location onsite where free-phase petroleum was detected, at the southeast portion of the DOT Parcel. This free-phase petroleum is not related to the much larger petroleum hydrocarbon groundwater plume on the site, however. Acetone and Methylene Chloride exceedances are likely laboratory artifacts rather than a site contaminant. The Acetonitrile exceedances are likely to be an artifact from the plastic well materials used to construct monitoring wells and the sole Chloroform exceedance is likely related to the municipal water, both of which were used during the field investigation.

Only seven additional constituents associated with industrial processes and activities, Benzo (a) anthracene (BAA), Benzo (a) pyrene (BAP), Benzo (b) fluoranthene (BBF), Dibenzo (a, h) anthracene (DAHA), 1,4-Dichlorobenzene, Naphthalene, and Nitrobenzene are present in soils at levels above respective ARARs. All except Nitrobenzene were detected in shallow soils at depths of less than 7 feet below the ground surface (BGS). BAP, BBF, DAHA, and Naphthalene exceedances were found in soils beneath the former building where vehicle maintenance activities were conducted. The vehicle maintenance activities may have resulted in this impact to soil or their presence may be related to the human placed fill in this area. The Nitrobenzene exceedances were also detected in these soils are likely a degradation product of the other constituents. BAA, BAP, BBF, DAHA, and Naphthalene exceedances were detected in soils beneath the former location of large-diameter gun production building and are likely related to those activities or the human placed fills in this area. BAP was also detected above its ARAR at two additional but isolated locations at the south-central border of the DOT Parcel and are likely related to the general industrial activities once conducted at the site and/or to have originated from the human placed fills in the area.

Only one particular polychlorinated biphenyl (PCB), chemicals once used in electrical transformer oil and electrical equipment, was detected in soil on the DOT Parcel above ARARs. PCB exceedances are present in sediments from three stormwater collection structures (these sediments are scheduled to be removed under an Interim Measure). Voluntary actions undertaken by the GSA-NCR in the recent past included removing soil impacted by the storage of PCB containing electrical equipment prior to shipping it to disposal facilities. The magnitude of exceedances detected during the RFI are notably lower than those detected previously and are remnants of the large-scale removals undertaken previously (voluntary removals were considered complete when a different, higher concentration, PCB level was achieved). PCB was also detected in shallow soils at three widely spaced locations beneath the location of the former large-gun production building. It is likely that these PCB impacts to soil are related to historic transformer use that may have occurred in the building.

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HYDROGEOLOGY

The site is underlain by at least two distinct water-bearing zones separated from each other by a continuous low-permeability clay layer that acts as a barrier to the migration of groundwater, and any contaminants that may be in the groundwater, from the upper zone into the lower zone. Both water-bearing zones currently flow in a westerly direction. The expected flow direction, based on scientific principles in the absence of human influences, would be to the south towards the Anacostia River. The current flow direction is most likely influenced by underground preferential flow pathways such as the nearby Metro system subway tunnels and the two combined sewers under the western portion of the site. Also, there is historic information that a large concrete structure ("gun barrel shrinkage pit"), up to 80-feet deep, is present at the western end of the former large-gun production building. Results of the RFI indicate that this structure is not acting as a preferential pathway for groundwater to flow between the two groundwater zones, even though it penetrates the clay layer between them. A groundwater flow travel time in the shallow groundwater zone is estimated at five-feet per year and in the deep groundwater zone at 0.8-feet per year.

CURRENT SITE SHALLOW GROUNDWATER QUALITY

Only three metals, Arsenic, Barium, and Thallium, are present in shallow groundwater at concentrations above ARARs. The exceedances were singular and isolated in nature. Therefore, these constituents are not likely an indication of overall groundwater quality degradation but may be related to natural variations in water chemistry.

Only eight constituents associated with industrial solvents and motor fuels, Benzene, Chloroform, 1,4-Dichlorobenzene, Ethylbenzene, Methyl-terbutyl-Ether (MTBE), Trichloroethene, Toluene, and total Xylenes are present in shallow groundwater at concentrations above ARARs. The Benzene, Ethylbenzene, Toluene, and total Xylenes (all constituents present in gasoline) are present in wells within the petroleum hydrocarbon groundwater plume which is emanating from an offsite source. The Chloroform and 1,4-Dichlorobenzene impact to shallow groundwater may be due to past industrial activities or more likely is indicating that a nearby domestic water/sewer pipe is leaking. The Trichloroethene exceedance was in only one sample from one well. The well is located within the location of the former vehicle maintenance building and the impact to groundwater is likely related to the activities once conducted in this former building. The MTBE is present in shallow groundwater near the location where the Trichloroethene was detected. These observations indicate that both the MTBE and chlorinated solvent impact to shallow groundwater is localized in extent. The MTBE is likely an indicator of impact to groundwater from the former UST or USTs located at the north end of the former vehicle maintenance building.

Only three additional constituent associated with industrial processes and activities, Bis (2-ethylhexyl) Phthalate, 2-Methylnaphthalene, and Naphthalene, are present in shallow groundwater at concentrations above respective ARARs. The detections were in four wells that are within the historic petroleum hydrocarbon groundwater plume.

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CURRENT SITE DEEP GROUNDWATER QUALITY

Only one metal, Barium, is present in deep groundwater at a concentration above ARARs. All soil samples at this same location contain exceedances of the Barium ARAR. Therefore, this constituent is not likely an indication of overall groundwater quality degradation but may be related to natural variations in water chemistry.

Only one constituent associated with industrial solvents and motor fuels, MTBE, is present in shallow groundwater at a concentrations above ARARs. Since this is the only ARAR exceedance for these types chemicals and it was detected in only one of two samples from the particular well, it is difficult to attribute this exceedance to a particular source.

Only one additional constituent associated with industrial processes and activities, Bis (2-ethylhexyl) Phthalate, is present in shallow groundwater at a concentration above ARARs. As is the case of MTBE, above, the detection was only in one of two samples from a single well. Therefore, it is difficult to attribute this exceedance to a particular source.

USE OF RESULTS

Throughout the report, discussions are presented in regard to constituent concentrations that exceed USEPA health-based risk screening levels (Applicable, Relevant, or Appropriate Requirement or ARARs). These exceedances are graphically displayed on figures and summarized in tables in this report. The USEPA data comparison methodology used resulted in many exceedances being displayed on the figures and highlighted in tables which may not actually be present in the site soils and/or groundwater. This discrepancy is due to the fact that for some constituents, the ARARs are lower than the level laboratory equipment can detect these constituents. The reader is therefore cautioned to not assume that a constituent is present merely because it is displayed on a drawing or highlighted in a table. The risk assessment, which will be conducted after soil and groundwater are removed from the DOT Site in order to construct the building will evaluate whether or not these "possibly present" constituents are likely to be "truly present" and therefore should be used to evaluate the cumulative increased risk site constituents may pose to human health and ecological receptors.

SECTION ONE

Introduction

1.1 BACKGROUND

On behalf of the U.S. General Services Administration National Capital Region (GSA-NCR), the current owner of the subject property, URS Group, Inc. (URS) has prepared this Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report. Prior to a corporate merger in 1998, URS operated as environmental consultant to GSA-NCR under the former company name of Woodward-Clyde Federal Services (WCFS). This document is intended to meet criteria specified in the U.S. Environmental Protection Agency Region III (USEPA) Final Administrative Order on Consent (CO), Docket Number RCRA-III-019AM, dated August 2, 1999. Criteria for the RFI Report are described in Section VI - Paragraph 33, and Attachment A - Tasks III, IV, and VI of the CO. Information presented in this document includes data and activities performed through July 2002.

The property that is the subject of this RFI Report is situated within an approximately 55-acre parcel of land owned by the U.S. Government and controlled by the GSA-NCR. The 55-acre parcel is located in Southeast, Washington, District of Columbia (D.C.) (Figure 1-1) and is known as the Southeast Federal Center (SEFC). The entire SEFC is covered by the CO. The CO, in general, specifies that the SEFC be investigated in accordance with Section 3013 of RCRA. The type of investigation conducted for the SEFC, including any sub-divided portion of the SEFC, is referred to as an RFI. Beginning in September 1999, URS prepared site history and workplan documents required in the CO on behalf of the GSA-NCR. On September 13, 2001 the USEPA conditionally accepted and approved the documents, provided the nine comments attached to their approval letter were addressed to the satisfaction of the USEPA. The documents conditionally approved by the USEPA form the basis of the RFI conducted on the subject property. These documents are as follows:

- Description of Current Conditions and Summary of Interim Measures/site Stabilization (DCC&IM/SS) – Final, dated April 16, 2001
- Use History and Proposed Investigation of Previously Undocumented Buildings and Areas (SI), dated February 13, 2001
- RFI Workplan Section: Data Collection Quality Assurance Plan (DCQAP) – Part 1 Field Sampling Plan (FSP), Revision 2, dated April 16, 2001
- RFI Workplan Section: DCQAP – Part 2 Quality Assurance Project Plan (QAPP), Revision 2, dated April 16, 2001
- RFI Workplan Section: Health and Safety Plan (HSP), Revision 2, dated April 16, 2001
- RFI Workplan Section: Project Management Plan (PMP), Revision 2, dated April 16, 2001
- RFI Workplan Section: Data Management Plan (DMP), Revision 2, dated April 16, 2001
- RFI Workplan Section: Community Relations Plan (CRP), Revision 2, dated April 16, 2001

The six workplan sections (FSP, QAPP, HSP, PMP, DMP, and CRP) are collectively referred to as the RFI Workplan.

SECTION ONE

Introduction

The property that is the subject of this RFI report is the proposed location of the new U.S. Department of Transportation (DOT) headquarters building and is hereinafter referred to as the "DOT Parcel". The DOT Parcel is approximately 11-acres in area and is situated in the north-central portion of the SEFC (Figures 1-2 and 1-3). The CO specifies that the entire SEFC is subject to the terms and conditions stated in the document. In an effort to begin development of the SEFC, the 11-acre DOT site was parceled out and in December 2001 the GSA-NCR requested URS conduct an RFI of it that was separate from the RFI of the entire SEFC. In a letter dated January 25, 2002 the USEPA formally approved GSA-NCR's approach of conducting an RFI of the DOT Parcel even though it represented only a portion of the entire SEFC.

1.2 SITE SETTING

The DOT Parcel is located in the southeast quadrant of Washington, D.C. as shown on Figure 1-1. The DOT Parcel is bounded to the north by M Street, Southeast (S.E.), to the east by the locations of former SEFC Buildings 135 and 309, to the south by SEFC Building 167 and the southern extent of Tingey Street, and to the west by SEFC Building 213 (Figures 1-2 and 1-3). Properties located further west (across First Street, SE) of the SEFC and north (across M Street, SE) of the DOT Parcel include industrial/warehouse, residential (high and low to medium density), retail, school/institutional, parking and parks zonings.

The DOT Parcel contains two remaining buildings, a security personnel checkpoint building at the Third Street, S.E. entrance to the SEFC (not shown on figures) and Building 170. The remainder of the DOT Parcel consists primarily of paved surfaces used for parking and concrete floor slabs of former buildings (Figure 1-3).

1.3 SITE HISTORY

A comprehensive summary of the history of the SEFC and DOT Parcel, and previously documented environmental conditions and interim measures/site stabilization activities conducted and completed as of the year 2000 is included in the DCC&IM/SS. Supplemental information on buildings and activities not included in the DCC&IM/SS is presented in the SI report.

Prior to 1800, much of the land now occupied by the SEFC was under water. An inlet of the Anacostia River cut across the DOT Parcel north to M Street, S.E., as well as an inlet or channel which penetrated the DOT Parcel at 2nd Street, S.E. (Figure 1-2). At the turn of the 19th Century, shipbuilding activities began due the pressures of an impending war. In 1803, President Thomas Jefferson designated the Washington Navy Yard (WNY) as the homeport of the U.S. Navy.

The WNY experienced three major periods of growth: late 1800s to 1902, World War I period and World War II period. The first expansion occurred just prior to the turn of the 20th Century, when WNY activities shifted from shipbuilding to ordnance (gun mechanisms) production. The expanded activities did not include the manufacture of munitions. Following the onset of the industrial revolution, ordnance manufacturing demanded larger buildings and thus the adjacent marsh and inlet were eventually filled in. The increasingly industrial character of the WNY resulted in the addition of electrical and railroad services.

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The second and largest period of expansion occurred as a result of the enormous increase in production at the weapons plant during World War I. By 1919, the WNY had more than doubled its size. To accommodate wartime production needs, almost two dozen buildings were constructed. The buildings ranged in size from small warehouses to large foundries. During this period the WNY was capable of producing 16-inch diameter gun barrels, 43 feet long, weighing 127 tons. A railroad system necessary to transport bulk and refined materials used in the manufacture of weapons transected the entire SEFC and portions of the DOT Parcel.

The third period of expansion occurred due to President Franklin D. Roosevelt's ambitions and desires to increase the power of the U.S. Navy. The WNY was the center for ordnance production and damaged vessel repairs during Word War II. Following the war, the advent of missiles and electronic equipment made ordnance production activities and manufacturing buildings at the WNY obsolete. All ordnance production and manufacturing ceased by 1962. In 1963, the western portion of the WNY was transferred from the Department of the Navy to the GSA-NCR in order to develop the SEFC.

Almost all of the buildings that have occupied the SEFC and the DOT Parcel were originally constructed as weapons production factories and workshops. These buildings, which ranged in size from 1,000 square feet (former Building 135) to 125,000 square feet (former Building 153), were either not renovated and demolished (Buildings 153, 226, 238, and 255) or were renovated to provide a wide variety of office space for different Federal departments and agencies and later demolished (Buildings 135, 191, 205, 216, 232, and 309). During the late 1990's, and as part of the planned redevelopment of the DOT Parcel, all but one building (Building 170) had been demolished (Figure 1-3).

1.4 RFI OBJECTIVE

The objective of the RFI process is the protection of human health and the environment through implementation of the USEPA approved RFI Workplan for the DOT Parcel. Successfully fulfilling this objective is achieved through performance of:

- Interim Measures and Site Stabilizations to mitigate threats to human health and/or the environment, and
- The RFI to assess the nature and extent of hazardous constituents that may be present and assess the increased risks their concentrations may pose to human health and/or the environment.

This report discusses the results of performing the RFI for the DOT Parcel. Descriptions of the voluntary Interim Measures and Site Stabilizations already conducted by the GSA-NCR on the DOT Parcel are in the DCC&IM/SS.

The CO and RFI Workplan specified that a Risk Assessment be conducted and included in the RFI Report. The purpose of conducting a baseline risk assessment is to provide an analysis of potential adverse human health effects that may be caused by the impacted soil and groundwater present assuming no actions are implemented to control or mitigate the contaminants.

SECTION ONE

Introduction

On July 24, 2002, GSA-NCR, URS, and representatives of the site development team attended a meeting hosted by the USEPA in Philadelphia, Pennsylvania. The meeting was requested by the GSA-NCR. Meeting agenda items included, but were not limited to, updating USEPA on progress of the RFI, presenting the proposed development plan and schedule, and presenting recommendations regarding the RFI Report submittal/review schedule and risk assessment.

The GSA-NCR and URS proposed deferment of conducting the risk assessment. Conducting a baseline risk assessment before construction would not accurately characterize risks to human populations and environmental systems because a large portion of the impacted soil and groundwater would be removed from the DOT Parcel during foundation excavation. The risk assessment would more appropriately be a part of interim measures plans for construction of the DOT building. In an August 16, 2002 letter, the USEPA approved this approach to the risk assessment, provided health and safety measures are implemented during excavation to protect sensitive human populations (e.g., construction workers, SEFC workers and visitors, and the public) and environmental systems. The USEPA approved approach also dictates that soil risks posed by soil contaminants will be kept as separate assessments for the DOT Parcel and SEFC, but that the SEFC RFI shall include an assessment using all groundwater data (i.e. those from the DOT Parcel are included). Please refer to Sections 5 and 6 for further information concerning the deferment of the Risk Assessment.

1.5 REPORT FORMAT

This RFI Report is divided into 11 discussion sections following this section. The general subject area of each proceeding section is as follows:

- Section 2 Environmental Setting - discusses the geologic, hydrogeologic, and physiographic conditions of the DOT Parcel,
- Section 3 Data Quality, Limitations, and Use – discusses activities conducted that were not described in the RFI Workplan and variations from procedures described in the FSP, the quality and usability of RFI data and data generated from previous investigations, assumptions used in presenting data from previous investigations, criteria used to exclude certain previous investigation data from further evaluation, and parameters tested for in the RFI and previous investigations,
- Section 4 RCRA Facility Investigation Results – presents data from the RFI and previous investigations in tabular format, explains data evaluation methods used to focus discussions of results on constituents of concern (COCs), and discusses the COCs nature and extent in both soil and groundwater within defined investigation areas on the DOT Parcel (Areas of Investigation or AOIs),
- Section 5 Identification of Potential Receptors – discusses the applicability of collecting data necessary to describe human populations and environmental systems that may be susceptible to exposure from contaminants present at the DOT Parcel,

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- Section 6 Risk Assessment – discusses the applicability of conducting a baseline risk assessment to provide an analysis of potential adverse human health effects that may be caused by the impacted soil and groundwater present at the DOT Parcel assuming no actions are implemented to control or mitigate the contaminants,
- Section 7 Investigation Derived Waste – describes the testing and proper disposal of solid and liquid wastes produced during the performance of RFI field investigation activities,
- Section 8 RFI Health and Safety – summarizes health and safety monitoring and reporting conducted during performance of RFI field investigation activities,
- Section 9 Summary of Findings – summarizes results, findings, and conclusions for site-wide soils, sediments from storm drains on the DOT Parcel, DOT Parcel-wide groundwater, and for each AOI,
- Section 10 Limitations – states the limits of reliance on the data and information presented or the findings, interpretations, or conclusions offered in this report,
- Section 11 List of References – listing of documents and publications used in preparing this report, and
- Section 12 List of Acronyms – listing of abbreviations and common acronyms used in this report.

Discussions presented in the report are supplemented by tables displaying measurement data which are included in the section entitled “Tables” (Volume 2). Certain measurement data are displayed graphically on maps, plans, and in cross-sections included in the section entitled “Figures” (Volume 1). Raw data, supplemental reports of data quality, and other information referred to in the text of the report are included in the section entitled “Appendices” (Volumes 3 and 4).

This RFI Report is contained in four volumes. Volume One contains the executive summary, Sections 1 through 12, and all figures. Volume Two contains all tables. Volume Three contains Appendices A through I, and Volume Four Appendices J through Q.

SECTION TWO

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2.1 GEOLOGY

Regional and local geology/hydrogeology information was collected during this investigation. All borings from this investigation were logged in the field by examining soil cuttings and split-spoon samples. This information was supplemented by data from previous DOT Parcel investigations and literature on local geology/hydrogeology {(K&D, 1991) (WCFS, 1996)}. Boring logs and monitoring well construction diagrams from this RFI are included in Appendix A. Logs of borings for which soil data were retained (Section 3) from the WCFS 1996 investigation and the K&D 1991 investigation are included in Appendices B and C, respectively. Two geologic cross sections (plan view of both shown on Figure 2-1, cross section A-A' shown in Figure 2-2 and cross section B-B' shown in Figure 2-3) were constructed for the DOT Parcel from selected soil borings.

The DOT Parcel is located within the Atlantic Coastal Plain Physiographic Province which is characterized by sequences of marine and terrestrial sedimentary deposits. The western limit of the province is commonly referred to as the Fall Line, where older crystalline rocks of the Piedmont Province begin to dip beneath the relatively new sediments of the Coastal Plain. The Fall Line is located approximately three miles northwest of the DOT Parcel.

In general, the Coastal Plain Province consists of an eastward-thickening wedge of unconsolidated gravels, sands, silts, and clays that have been deposited upon an eroded crystalline basement rock surface that slopes downward towards the east. Many depositional environments existed during the formation of the Coastal Plain. Glacially influenced marine transgressions and regressions, periods of erosion and deposition, fluvial (riverine) processes, and structural deformations have all played a part in the evolution of the Coastal Plain. As a result of these varying processes, the presence, thickness, and lateral continuity of geologic formations are highly variable.

Two primary geologic units were identified during this investigation, in addition to fill materials encountered at the DOT Parcel. The uppermost geologic unit is comprised of Quaternary age river terrace deposits of interbedded gravel, sand, silt, and clay. The river terrace deposits were found to unconformably overlie the denser interbedded Cretaceous sands and clays of the Potomac Group. General descriptions of each stratum, from the ground surface downward, are as follows:

- Fill (Stratum F) – Development of the SEFC has resulted in significant excavation, dumping, construction and demolition, and significant filling to create the present surface. Fill is generally composed of inorganic sands, silts, and clays obtained from nearby materials. The fill encountered at the SEFC often includes construction and demolition debris, particularly within former building footprints. Fill also has been placed in the former canal located between Canal Street and 2nd Street, in areas of former and current utilities, and within former in-ground structures. Fill thicknesses on the DOT Parcel range up to approximately 20 feet. Fill was generally thickest in the footprint for former Building 153 and in north portions of the former canal.

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- Terrace Clays (Stratum TC) – Terrace clays are generally soft to very stiff, red-brown or gray-brown, clays and silts. The terrace clays were found over a large portion of the DOT Parcel, and are sometimes interbedded with terrace sands (Stratum TS). The terrace clays range in thickness from less than one foot to approximately 35 feet in the northwestern and far southwestern corner of the DOT Parcel.
- Terrace Sands (Stratum TS) – Terrace sands are generally loose to very dense, red-brown to gray-brown, fine to coarse sands with very little silt. The lower portions of the terrace sands, near where they unconformably overlie the Potomac Group sediments, are coarser than the upper portion and often contain gravel or predominantly consist of gravel and cobbles. The terrace sands were found over a large portion of the DOT Parcel, and are sometimes interbedded with the terrace clays. The terrace sands appear to be more predominant than the terrace clays within the DOT Parcel.
- Potomac Clays (Stratum PC) – Potomac Clays are generally very stiff to hard, red-brown to gray-brown clays and silts with occasional pockets of sand. The Potomac Clays are often interbedded with the Potomac Sands, and are generally more extensive than the sands. The clays range in thickness from less than one foot to greater than 40 feet. The top of the uppermost Potomac Clay layer within the DOT Parcel is located approximately 30 to 35 feet below Mean Sea Level (MSL), and acts as a groundwater confining layer. In general, the uppermost Potomac Clay layer gradually grades with increasing depth from a clay to a silt, to a sandy silt before grading to the underlying Potomac silty sands and sands. The uppermost Potomac Clay layer ranges in thickness from 10 feet to greater than 40 feet over most of the DOT Parcel. Historical boring logs indicate the uppermost Potomac Clay layer to be as thick as two feet in the far southwest corner of the DOT Parcel. Previous studies indicate that the uppermost Potomac Clay layer pinches out south of the DOT Parcel.
- Potomac Sands (Stratum PS) – Potomac Sands within the DOT Parcel are generally dense to very dense, gray, greenish-gray and brownish-gray, fine to medium sands and silty sands with a few zones of fine to coarse sand. The Potomac Sands are often interbedded with stratum PC and appear to be more extensive than the clays in the eastern portion of the DOT Parcel. The sands range in thickness from less than one foot to greater than 50 feet.

Other studies show that alluvial clays and silts exist south of the DOT Parcel near the Anacostia River.

2.2 HYDROGEOLOGY

The Atlantic Coastal Plain hydrogeology is characterized by numerous water-bearing zones consisting primarily of sands and gravels, separated by less permeable zones of silts and clays (aquitards). The water-bearing zones can occur under both unconfined (water table) and confined (artesian) conditions, depending on the presence and thickness of low permeability confining units.

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Although the groundwater in the DOT Parcel flows through porous media, the topography is relatively flat. Therefore, groundwater flow velocity is slow, moving on the order of about one foot per year.

A total of 20 groundwater monitoring wells, as shown in Figures 2-4 and 2-6, have been installed on the DOT Parcel. Two were installed by K&D as part of their July 1991 Phase II ESA investigation, five were installed by WCFS as part of their April 1996 Phase II Environmental Site Assessment Update, and 14 were installed as part of this investigation. We have excluded from this discussion RFI wells BC-MW18, BC-MW19, and BC-MW20 which were installed solely for monitoring groundwater levels during the aquifer pump test (Section 3.1). Table 2-1 summarizes well depth and screened interval elevations for the 20 monitoring wells. Fourteen of these wells, ranging in depth from 25 to 39 feet below ground surface (BGS), were installed to assess contaminant impacts to groundwater in the uppermost water-bearing zone (shallow groundwater zone). Eight of these wells are deep wells (seven wells are approximately 80 feet deep and one {MW13} is approximately 110 feet deep). The deep wells are screened beneath the uppermost confining layer of the Potomac Clays, and within the Potomac Sands. In some cases, where Potomac Sands were not encountered, the deep wells were screened within silty layers of the Potomac Clay. The purpose of installing the deep wells was to assess the environmental impacts in groundwater in the lower water-bearing zone (deep groundwater zone).

Deep and shallow wells were installed as pairs at three locations (BC-SB/MW01 and BC-SB/MW02; BC-SB/MW05 and BC-MW06 {RFI wells}; as well as MW10/MW13 {WCFS installed wells}) to investigate the relationship between the two water bearing zones.

2.2.1 Groundwater Flow Direction

The hydrogeology in the vicinity of the DOT Parcel is characterized by the sandy units of the river terrace and Potomac group deposits. These sandy units beneath the site are separated by the uppermost layer of Potomac group clays and silts which act as a groundwater confining layer resulting in two water bearing zones; the unconfined shallow zone and the confined deep zone consisting of Potomac group sands and silts. This is evidenced at shallow/deep well pairs BC-SB/MW10 and MW13; BC-SB/MW01 and MW02; and BC-SB/MW05 and MW06, where water levels in the deeper wells were approximately 1.0 to 2.5 feet higher than their corresponding shallow wells (Table 2-2). Water level measurements for the two rounds of sampling are included in Table 2-2. The DOT Parcel confining layer ranges in thickness from 10 feet to greater than 40 feet over most of the site. Historical boring logs indicate the uppermost Potomac Clay layer to be as thick as two feet in the far southwestern corner of the DOT Parcel. Previous studies indicate that this confining layer pinches out just south of the DOT Parcel.

Depths to groundwater in the majority of the monitoring wells (both deep and shallow) place the groundwater at elevations from approximately 5 ½ feet above MSL to 5 ½ feet below MSL. Only two of the monitoring wells (BC-SB/MW08 and BE-SB/MW06) had water levels above MSL. Previous experience in the Washington DC area indicates that groundwater levels are closely associated with activities such as construction dewatering, the location of Metro (subway) tunnels, or deep utilities and are frequently found at depths below MSL.

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In general, the regional surface groundwater flow would be expected to be to the south, towards the Anacostia River, located south of the DOT Parcel. However, on the DOT Parcel, the groundwater in the shallow zone flows towards the west and northwest. The groundwater flow direction in the deep zone is towards the west. Groundwater contour maps for the shallow zone during round 1 sampling (January 30 to February 1, 2002) and round 2 sampling (March 28, 2002) are included in Figures 2-4 and 2-5, respectively. Groundwater contour maps for the deep zone during round 1 sampling (January 30 to February 1, 2002) and round 2 sampling (March 28, 2002) are included in Figures 2-6 and 2-7, respectively.

Artificially low groundwater conditions and unnatural groundwater flow direction in the shallow zone at the DOT Parcel may be caused by a combination of one or more of the following factors:

- The majority of the site, and much of the surrounding area, is paved or covered with structures thereby limiting recharge to the shallow groundwater zone.
- Two particularly large combined sanitary/stormwater sewer tunnels are present in the western portion of the site beneath former Building 205 and former Building 216 along the western boundary of the DOT Parcel. These utility tunnels would primarily affect shallow zone groundwater in their immediate vicinity.
- Building excavation dewatering across M Street, S.E. north of the DOT Parcel which occurred during the fieldwork phase of the RFI, would likely affect shallow zone groundwater flow.
- Two Metro tunnels cross the DOT Parcel in a northwest to southeast direction. The tunnels extend in an arc from the Navy Yard Metro Subway Station near the northwest corner of the site to the southeast corner of the site. The tunnels then continue beneath the Anacostia River. Information obtained from WMATA demonstrates that the invert of the tunnel is below the Potomac Clay layer until it reaches the area where Second Street, S.E. and M Street, S.E. intersect. At this point the tunnel is at about -40 feet elevation and reaches -30 feet elevation at the Navy Yard Station further to the west. The station and tunnel are continually dewatered by gravity drainage to the access shaft west of Fourth Street, S.E. on the SEFC. WMATA reports that approximately 6,000 gallons of water per day collect in the shaft sump and are discharged by pumping the water into a stormwater line near ground surface and eventually discharging to the Anacostia River. WMATA does not conduct any chemical parameter testing/monitoring of this discharge water.
- Broken water supply pipes and sewers, common in urban areas such as the site with aging infrastructure may act as artificial recharge areas that locally affect groundwater flow. This may explain the artificially high water level (5 to 5 ½ feet above MSL) at well BE-SB/MW06 (Figures 2-4 and 2-5).

It should be noted that historical shallow groundwater flow has been depicted in a different direction, sometimes nearly the opposite direction as to the current groundwater flow. Again this can be attributed to the items listed above.

Other relatively deep utilities may also provide preferential pathways for groundwater migration.

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The deep zone groundwater flow direction is towards the west (Figures 2-6 and 2-7). The groundwater flow direction for the deep zone aquifer may be affected by one or more of the following factors:

- Dewatering for the Navy Yard Metro Station, located just to the northwest of the site, may impact groundwater flow depending on the bottom elevation of the station. The station and tunnel are continually dewatered by gravity drainage to the access shaft west of Fourth Street, S.E. on the SEFC. WMATA reports that approximately 6,000 gallons of water per day collect in the shaft sump and are discharged by pumping the water into a stormwater line near ground surface and eventually discharging to the Anacostia River.
- The two Metro tunnels noted above have invert elevations ranging from approximately 45-90 feet below MSL. These structures and fill material associated with these tunnels may impact deep zone groundwater flow. Information obtained from WMATA demonstrates that the invert of the tunnel is below the Potomac Clay layer until it reaches the area where Second Street, S.E. and M Street, S.E. intersect. At this point the tunnel is at about -40 feet elevation and reaches -30 feet elevation at the Navy Yard Station further to the west. The station and tunnel are continually dewatered by gravity drainage to the access shaft west of Fourth Street, S.E. on the SEFC. WMATA reports that approximately 6,000 gallons of water per day collect in the shaft sump and are discharged by pumping the water into a stormwater line near ground surface and eventually discharging to the Anacostia River.
- Additionally, the condition of an 80 to 100-foot deep former gun barrel shrinkage pit constructed of reinforced concrete is unknown (Apex, 1990) (K&D, 1991). This structure could affect groundwater flow in the deep zone. Since this pit passes through the confining uppermost Potomac Clay aquitard, the pit could act as a conduit for the flow of groundwater between the upper and lower water bearing zones depending on its construction, the permeability of its surrounding backfill, and its condition. However, as described in Section 4, groundwater contaminants detected above the reporting limit in the shallow zone are absent from the deep zone. This pit is discussed in more detail in Section 4.2.1.

No known water supply wells exist in the vicinity of the DOT Parcel.

2.2.2 Hydraulic Properties of the Site

2.2.2.1 Slug Test Data

Slug testing was completed in February 2002 on ten DOT Parcel monitoring wells including MW03, MW05, MW12, BC-MW02, BC-SB/MW05, BC-SB/MW07, BC-SB/MW08, BE-SB/MW02, BE-SB/MW08, and G2-SB/MW03. The objective of the slug testing was to evaluate hydraulic conductivities of subsurface hydrogeologic deposits. These data aided in evaluating groundwater flow rates and provided important basic data needed for evaluating the risk to human health and the environment associated with migration of groundwater contaminants at the site (the risk assessment will be presented in the URS RFI Report for the remainder of the SEFC).

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Slug testing was conducted in accordance with Standard Operating Procedure (SOP) H1 of the FSP. Both falling-head and rising-head slug tests were performed on the wells. The falling-head tests were performed by the instantaneous insertion of a known volume (slug) into a monitoring well in which the water level was at equilibrium, thereby raising the water level within the well. The subsequent fall in water level was measured over time as it returned to the equilibrium level. The rising-head tests were performed by the instantaneous removal of the slug from a monitoring well when the water level was at equilibrium, thereby lowering the water level within the well. The subsequent rise in water level was measured over time as it returned to the equilibrium level.

Before starting a falling-head test, the static water level was measured and a pressure transducer was then placed in the monitoring well. The pressure transducer was connected to an automatic data logger. To start the falling-head test, the data logger was activated and the slug was simultaneously inserted and submerged in the water column of the monitoring well. Once the water level returned to its equilibrium level, the data logger was stopped and the falling head test was completed. The rising head test was initiated upon withdrawal of the slug and simultaneously restarting the data logger to record the rising-head. The rising-head test was completed when the water level returned to its equilibrium level and the data logger was then stopped. The automated data logger recorded water level readings at preset intervals on a logarithmic scale during the tests.

Slug-test data for both the falling and rising head tests were analyzed to calculate hydraulic conductivities (k) using the Bouwer and Rice analytical method (Bouwer and Rice, 1976 and 1989). Interpretation of these data was aided by using the computer software package AQTESOLV™. Plots of the slug-tests are provided in Appendix O. Results of the slug-test data analyses are summarized in Table 2-3.

Hydraulic conductivity values interpreted from the slug-tests range from 2.04×10^{-5} to 3.73×10^{-3} centimeters/second (cm/s) for falling-head tests (insertion) and from 2.92×10^{-5} to 4.84×10^{-3} for rising-head tests (withdrawal), with geometric means of 2.24×10^{-4} for falling-head tests and 2.17×10^{-4} for rising-head tests. These values are consistent with typical hydraulic conductivity values for similar geologic materials in the Washington DC area.

2.2.2.2 Pump Test Results

The FSP-specified constant rate aquifer pumping test was conducted between July 22 and 23, 2002 at pumping well BC-MW06. Water levels were monitored in selected surrounding wells within the DOT Parcel including BC-MW20, BC-SB/MW05, BC-MW18, BC-MW19, G2-SB/MW04, MW05, MW10, MW11, and G2-SB/MW06. The objective of the pump testing was to provide information necessary to characterize the hydraulic properties of the shallow groundwater zone and evaluate the interaction, if any, between the shallow and deep groundwater zones. These data aided in evaluating groundwater flow rates and provided important basic data needed for evaluating the risk to human health and the environment associated with migration of groundwater contaminants at the DOT Parcel (the risk assessment will be presented in the URS RFI Report for the remainder of the SEFC).

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A four-inch diameter well, BC-MW06, served as the pumping well for the test. The well was constructed to fully penetrate the upper aquifer by setting the screen from 5 to 39 feet BGS. Utilization of a fully penetrating pumping well at this location maximized the sustainable pumping rate and thereby stressed as large a portion of the water bearing zone as possible.

The pumping test was conducted using a constant pumping rate of about 8 gallons per minute (gpm) for a duration of 24 hours. The test was conducted in general accordance with SOP No. 6 of the FSP. Water level readings were recorded in the pumping well and four other wells including BC-MW18, BC-MW19, BC-MW20, and G2-SB/MW04 using pressure transducers and an INSITU HermitTM 3000 automated data logging system during the pumping test and recovery period. Water levels were also recorded manually using a water-level indicator in five additional wells, including BC-SB/MW05, G2-SB/MW06, MW05, MW10, and MW11, once each hour during the pumping test and recovery period. Recovery phase water-level readings were collected for a period of eight hours following completion of the pumping phase before heavy rains prevented further collection of accurate water level data.

The results of the pumping phase and recovery phase of the constant-rate test are summarized in Table 2-4. Plots of pumping and recovery data are included in Appendix P. Pumping and recovery phase data were analyzed using both the Neuman (1975) and Cooper Jacob (1945) analytical methods with the aid of the software package AQTESOLVTM. The recovery test for the pumping well BC-SB/MW06 was also analyzed in AQTESOLVTM. The resulting hydraulic conductivity from the Bouwer-Rice Method is 1.66×10^{-5} cm/sec.

The results of the pumping phase data indicate transmissivity values ranging from $3.02 \text{ cm}^2/\text{sec}$ to $11.43 \text{ cm}^2/\text{sec}$. Based on water bearing zone thickness of 40 feet, these values represent hydraulic conductivities ranging from $3.97 \times 10^{-3} \text{ cm/sec}$ to $1.50 \times 10^{-2} \text{ cm/sec}$. These values range from two times to one order of magnitude greater than those calculated using slug-test data. However, this result is not unexpected since slug-test results typically underestimate hydraulic conductivity. Transmissivity values interpreted from the recovery phase data range from $0.29 \text{ cm}^2/\text{sec}$ to $1.16 \text{ cm}^2/\text{sec}$. These values are in general 0.5 to 1 order of magnitude lower than those for the pumping phase. The hydraulic conductivities calculated from the recovery test data ranged from 3.87×10^{-3} to $1.52 \times 10^{-2} \text{ cm/sec}$.

The geometric mean of all calculated hydraulic conductivity values from the pumping phase data is $1.09 \times 10^{-2} \text{ cm/sec}$. This hydraulic conductivity value indicates that the upper aquifer has moderately high hydraulic conductivity. The pumping well was pumped at a rate of 8 gpm with 3.7 feet of drawdown with no indication of the well going dry.

Specific yield values interpreted from the pumping phase data have a geometric mean of $10.60 \text{ cm}^2/\text{sec}$ and $6.01 \text{ cm}^2/\text{sec}$ as interpreted from the Cooper-Jacob and Neuman method results, respectively. The geometric mean of all calculated specific yield values for the pumping test is $8.31 \text{ cm}^2/\text{sec}$.

The results of the recovery phase data indicate transmissivity values ranging from $0.29 \text{ cm}^2/\text{sec}$ to $1.16 \text{ cm}^2/\text{sec}$. Based on an aquifer thickness of 40 feet, these values represent calculated hydraulic conductivities ranging from $3.87 \times 10^{-3} \text{ cm/sec}$ to $1.53 \times 10^{-3} \text{ cm/sec}$. The geometric mean of the hydraulic conductivity values for the recovery test data is 1.20×10^{-3} . Specific yield values interpreted from the recovery phase data have a geometric mean of $1.07 \text{ cm}^2/\text{sec}$ and $0.76 \text{ cm}^2/\text{sec}$ for the Cooper-Jacob and Neuman method results, respectively. The geometric mean for

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all calculated specific yield values for the recovery test is 0.91 cm²/sec. This value is less than one order of magnitude lower than that calculated from the pumping phase test.

It should be noted that the results of the pumping and recovery phase data for some of the wells tested are of relatively poor quality and were therefore not used in calculating the geometric means as an indication of overall aquifer properties. These results are designated as N/A in Table 2-4. However, all results of the pump-test analysis for wells yielding pumping or recovery displacement vs. time information are presented in Appendix P. Those wells that did not yield either pumping or recovery displacements were likely too distant from the pumping well, or they were deep zone monitoring wells – all or which showed no response to pumping in the shallow zone above. Other well displacements yielded unrealistically high values for transmissivity because data were insufficient to create a valid best-fit curve for either the Cooper-Jacob and/or Neuman methods.

2.2.2.3 Groundwater Flow Velocity

Using a derivation of the classic Darcy's equation, URS calculated the apparent groundwater flow velocity (flux) for both the shallow and deep groundwater zones. While using the derivation results in an approximate groundwater velocity, the values calculated represent, generally, an upper boundary of true groundwater velocity and are useful in assessing contaminant travel times from a source to the point of interest. The equation used is as follows:

$$V = Ki$$

V = specific discharge or Darcy velocity
 k = hydraulic conductivity
 i = hydraulic gradient

The Darcy velocity for the shallow groundwater zone is 1.1×10^{-6} cm/sec (0.003 ft/day or 1 ft/year) using the average k derived from slug testing and 4.9×10^{-6} cm/sec (0.014 ft/day or 5 ft/year) using the average k derived from pump testing. The hydraulic gradient for the shallow zone was evaluated using wells G2-SB/MW03 and BC-MW02 (Figure 2-4). The head difference between these two wells is 3.81 feet (Round 2 groundwater elevations, Table 2-2) and the distance between them is approximately 775 feet (Figure 2-4). These parameters yield a hydraulic gradient of 4.9×10^{-3} . Based on this calculation apparent groundwater flow in the shallow zone is expected to be between 1 ft/year and 5 ft/year.

The Darcy velocity for the deep groundwater zone is 7.1×10^{-7} cm/sec (0.002 ft/day or 0.8 ft/year) based on the average k (5.1×10^{-4} cm/sec) for deep zone wells slug tested (BC-SB/MW05, BC-SB/MW07, MW-05, and MW-10). The hydraulic gradient for the deep zone was evaluated using wells MW11 and MW05 (Figure 2-6). The head difference between these two wells is 1.19 feet (Round 1 groundwater elevations, Table 2-2) and the distance between them is approximately 850 feet (Figure 2-6). These parameters yield a hydraulic gradient of 1.4×10^{-3} . A pump test of the deep zone was not conducted, therefore, a Darcy velocity could not be calculated based on pump test data.

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2.3 PHYSIOGRAPHY

The average elevation at the DOT Parcel is approximately 15 feet National Geodetic Vertical Datum (NGVD). In general the site slopes gently to the south-southeast. The topographic high point, at approximately 18 feet NGVD, is located near former 2nd Street and M Street at the north portion of the site and the lowpoint is approximately 12 ½ feet near the southeast corner of the site in the parking lot north of Building 167. At the time of the RFI fieldwork, the DOT Parcel consisted primarily of asphalt parking areas and concrete slabs on grade at the location of demolished buildings. Building 170 was the only building still existing on the site. Figure 1-3 displays the former building locations.

2.4 CLIMATE

Washington, D.C. has a temperate climate with warm, humid summers and mild winters. The coldest weather occurs in late January and early February (average low 27 degrees Fahrenheit [°F]) and the warmest in July (average high 88°F).

There are no well-pronounced wet and dry seasons. Summer thunderstorms often bring sudden and heavy rain showers that may be accompanied by damaging winds, hail or lightning. Tropical disturbances during their northward passage occasionally influence Washington's weather, mainly with high winds and heavy rainfall. Snow accumulations of more than ten inches are relatively rare. Average annual precipitation is 39 inches.

Prevailing winds in the winter are from the northwest. By late spring, the prevailing direction shifts with winds coming from the south. By late fall, the prevailing wind direction shifts back to the northwest. Wind intensities average eight to ten miles per hour.

SECTION THREE

Data Quality, Limitations, and Use

This section describes the results of URS conducting a validation of 100% of the laboratory data generated as a result of implementing RFI Workplan investigation activities. The RFI data validation was conducted following USEPA guidance (USEPA, 1993 and USEPA, 1994a) by URS. Although not a third party data validation, the URS data validators did not conduct any other RFI activities. It also includes discussions of the quality and usability of data generated during previous investigations and soil remediation actions (excavation confirmation sampling). Discussions of previous data also include whether they were validated at the time they were published and, if not, the likelihood that necessary laboratory quality assurance and quality control (QA/QC) data could be obtained in order to perform a validation. Recommendations are also presented regarding how the RFI data and previous data should be viewed and used in the future.

Previous investigations conducted on the DOT Parcel included the collection of both soil and groundwater samples. Groundwater samples were collected from either constructed monitoring wells or Hydropunch™/well-point borings. Prior to the RFI field investigation, the most recent investigation conducted was completed in 1996. Since 6-year-old groundwater data may not be representative of current conditions and Hydropunch™/well-point sample data are accepted by the U.S. Environmental Protection Agency (USEPA) only for screening and qualitative purposes, only groundwater data generated during the two rounds of sampling conducted in accordance with the RFI Workplan are presented and considered in this report.

Tables 3-1 and 3-2 present listings of previous investigation/remediation sample identifications, collection dates, site locations, matrix, depth interval, chemical parameters analyzed, and which consultant/company collected the samples. The DCC&IM/SS presents these data and discuss the results of each previous investigation and voluntary soil remediation effort undertaken by the GSA-NCR. In accordance with the RFI Workplan, all previous data were evaluated for inclusion in the RFI process. Based on this evaluation data were either retained for, or excluded from, further evaluation in the RFI. Table 3-1 lists previous data locations that were retained and Table 3-2 lists previous data locations that were excluded from further consideration in this RFI. Data were excluded for one or more of the following reasons:

- Soil samples were collected from borings, well boreholes, well-point borings, or Hydropunch™ borings and were not submitted for laboratory analysis,
- Soil samples collected from borings, well boreholes, or Hydropunch™ borings were screened using immunoassay testing techniques and were not submitted for laboratory analysis,
- Soil samples were from exploration locations where contaminated soil was voluntarily excavated and removed to a defined depth. On the DOT Parcel three of the excavations were completed without achieving the voluntary remediation goals. These excavation areas, F1, G1, and G2 were further investigated in this RFI and excavation confirmation sample data were re-compared to RFI criteria.
- Soil samples were collected and analyzed for total petroleum hydrocarbon (TPH) exclusively (TPH is an indicator parameter composed of many individual compounds, therefore TPH concentrations are not useful in assessing risks to human populations and environmental systems), and

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- Soil samples were collected for the sole purpose of closure of an underground storage tank (UST) system. This type of sample is not typically collected for the purpose of assessing future risks posed by remaining constituents and the parameters analyzed are often only one (Naphthalene) to four compounds (Benzene, Toluene, Ethylbenzene, and Xylenes [BTEX]).

3.1 RFI DATA

3.1.1 RFI Workplan Modifications and Additions

All RFI data collection activities were conducted in accordance with the USEPA approved RFI Workplan as modified by responses to USEPA comments contained in their September 13, 2001 approval letter. The responses are contained in an October 18, 2001 letter (URS, 2001c) and included concurrence on eliminating two proposed sampling locations on the DOT Parcel and one on the SEFC, clarification of analytical extraction/digestion procedures and method detection limits (MDLs), clarification of elements of the CRP, and clarification of groundwater sampling criteria.

3.1.1.1 Sampling and Analysis

Due to changed conditions experienced in the field, the following modifications were necessary for specific AOI exploration locations:

- Deep zone groundwater monitoring well BC-SB/MW01 was installed to a depth of 85-feet BGS rather than the 80-feet BGS depth specified in the FSP. BC-SB/MW01 was installed deeper than planned because split-spoon samples indicated that soils shallower than 80-feet BGS were composed of lean clay, a soil that would likely produce an inadequate amount of water for groundwater sampling.
- Shallow zone groundwater monitoring well BC-SB/MW08 was installed to a depth of 32-feet BGS rather than the 40-feet BGS depth specified in the FSP. BC-SB/MW08 was installed shallower than planned because obstructions (cobbles) were encountered that could not be drilled through.
- Split-spoon samples at soil boring/monitoring well pair BC-SB/MW01 and BC-MW02 were collected from both locations rather than only at BC-SB/MW01 as specified in the FSP. Split-spoon samples were not collected from the upper 40-feet BGS depths in boring BC-SB/MW01. Instead, the requisite soil samples were collected while drilling the borehole for monitoring well BC-MW02. Split-spoon soil samples were collected from 40-feet BGS and deeper at location BC-SB/MW01. The shallow samples were collected from BC-MW02 instead of from BC-SB/MW01 in order to expedite sampling. The wells in this pair are located approximately 28-feet apart.

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- The first installation of monitoring well BE-SB/MW06 failed because prior to placing grout in the borehole above the bentonite pellet seal, the sand-pack had collapsed to a depth below the top of the well screen. A new borehole was drilled approximately 3-feet south and 5-feet east of the initial location. Monitoring well BE-SB/MW06 was then constructed at the offset location without further difficulty. Since the FSP specified soil samples had been collected at the initial location, none were collected during drilling of the offset location.
- The boundary of proposed DOT Parcel was not clearly defined at the time URS was directed to conduct a separate RFI for the approximately 11-acre parcel. Therefore, sampling from pre-existing monitoring well MW18 (Figure 1-2), a deep groundwater zone well, was not conducted during the first round of DOT Parcel groundwater sampling. MW18 was sampled during the second round of groundwater sampling.
- As a result of publishing the QAPP in April 2001 and conducting laboratory analyses in 2002, four MDLs were revised from those stated in the QAPP (revisions based on mandatory annual MDL studies). One soil MDL was revised: Isobutanol – MDL decreased from 10 micrograms per kilogram ($\mu\text{g/Kg}$) to 4.9 $\mu\text{g/Kg}$. Three water MDLs were revised: Acrolein – MDL increased from 2.9 micrograms per liter ($\mu\text{g/L}$) to 6.4 $\mu\text{g/L}$, Acrylonitrile – MDL increased from 1.69 $\mu\text{g/L}$ to 2.73 $\mu\text{g/L}$, and Isobutanol – MDL decreased from 5.13 $\mu\text{g/L}$ to 4.16 $\mu\text{g/L}$.

In a letter dated January 25, 2002 USEPA approved GSA-NCR's approach of conducting an RFI of the DOT Parcel even though it represented only a portion of the SEFC. However, USEPA explained that in order to be in compliance with the CO, two rounds of groundwater sampling across the SEFC, at least 90 days apart, had to be conducted. Therefore, GSA-NCR directed URS to conduct two rounds of groundwater sampling to satisfy USEPA's conditional approval of the RFI for the DOT Parcel. Since the schedule for the RFI of the DOT Parcel included conducting the first round of groundwater sampling before wells had been installed across the remainder of the SEFC, round two of DOT Parcel groundwater sampling coincided with round one of groundwater sampling on the remainder of the SEFC. Therefore, in order for there to be a second round of sampling across the entire SEFC, a third round of sampling on the DOT Parcel was conducted. However, these data are not included in this report due to the DOT Parcel RFI submittal schedule and site development schedule.

3.1.1.2 Additional Areas of Concern

Three additions to the RFI Workplan were presented and approved by the USEPA during performance of the RFI for the DOT Parcel. The additions are as follows:

- Collection of sediment samples from storm water catchment structures that reportedly contained detectable concentrations of polychlorinated biphenyls (PCBs) and collection of shallow soils from areas topographically upgradient of some of the structures (the upgradient areas are near historic areas of PCB storage),

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- Installation of three additional soil boring/monitoring wells (G2-SB/MW04, G2-SB/MW05, and G2-SB/MW06 shown on Figure 1-3) around G2-SB/MW03 (well G2-SB/MW03 contained measurable phase separated hydrocarbon {PSH} and the three additional wells were installed to evaluate the nature and extent of PSH), and
- Installation of three 2-inch diameter groundwater level monitoring wells around BC-MW06 for the purpose of conducting the FSP specified aquifer pump test.

Section 4.2.6 discusses the background and objective for collecting sediment samples from storm water catchment structures and sampling soil from possible source areas. It also presents data and discusses findings from the investigation.

Section 4.2.7 discusses the background and objective of conducting the investigation around G2-SB/MW03 to assess the nature and extent of PSH found in the monitoring well. It also presents data and discusses findings from the investigation. Please note that only one round of groundwater samples were collected from these three wells since they were installed after the first round of samples had been collected from other wells on the DOT Parcel.

The scope of the aquifer testing program described in the RFI Workplan included conducting a 24-hour pump test using wells BC-MW02 and BC-SB/MW01 as the designated pumping wells. The specific wells to be included in the pump test were described in URS' letter dated January 21, 2002, which was subsequently approved by EPA. However, the results of the slug testing, summarized in a separate letter report, indicate relatively low permeability conditions at well BC-MW02 (4.63×10^{-5} cm/sec – see Section 2). Based on this information, and the low recharge rates observed during low-flow groundwater sampling, URS concluded that well BC-MW02 would not likely yield measurable drawdowns in adjacent wells when pumped at a sustainable rate. Instead, with the approval of the EPA, pump testing was performed on well BC-MW06.

On February 27, 2002 URS mobilized to the site to conduct a step-drawdown test in well BC-MW02. The purpose of the test was to assess the optimum pumping rate for a 24-hour pumping test. However, it was not possible to complete a step-drawdown test in the well because it did not produce a sufficient yield during pumping.

As a contingency, URS conducted step-drawdown tests at three additional shallow groundwater zone monitoring wells (BE-SB/MW04, BC-MW06, and MW13 – see Figure 1-3) to evaluate their potential for use as alternative pump wells. These three wells were designated for monitoring during the planned pumping test. The tests at wells BE-SB/MW04 and MW13 were not successful. However, well BC-MW06 was pumped at 0.8 gallons per minute (GPM) for 15 minutes and 2.3 GPM for an additional 20 minutes. The results indicated that well BC-MW06 exhibited approximately 0.5 feet and 1.5 feet of drawdown at pumping rates of 0.8 and 2.3 GPM, respectively. Based on these results, it was estimated that well BC-MW06 could be pumped at a rate of 5 GPM with approximately of 5 to 8-feet of drawdown. Thus the well appeared to be suitable as a pumping well. Although well BC-MW06 provided a suitable yield for use as a pumping well, there were no shallow monitoring wells located in close proximity to BC-MW06.

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URS recommended that slug testing of the remaining DOT Parcel monitoring wells be conducted as an alternative to the planned pump test. On June 4, 2002 the USEPA informed the GSA-NCR that a pump test would be required regardless of well locations. Therefore, three 2-inch diameter monitoring wells were installed at varying distances from the selected pumping well BC-MW06. The three wells, BC-MW18, BC-MW19, and BC-MW20, were installed northwest, northeast, and south of BC-MW06 (Figure 1-3). Construction details of these three wells are included in Appendix A. Since these wells were installed to facilitate successful completion of the RFI Workplan pump test, soil and groundwater samples were not collected. The USEPA approved this approach that soil and groundwater samples would not have to be collected at these three locations.

3.1.1.3 RFI Risk Assessment Deferment

The CO and RFI Workplan specified that a Risk Assessment be conducted and included in the RFI Report. The purpose of conducting a baseline risk assessment is to provide an analysis of potential adverse human health effects that may be caused by the impacted soil and groundwater present assuming no actions are implemented to control or mitigate the contaminants.

On July 24, 2002, GSA-NCR, URS, and representatives of the DOT Parcel development team attended a meeting hosted by the USEPA in Philadelphia, Pennsylvania. The meeting was requested by the GSA-NCR. Meeting agenda items included, but were not limited to, updating USEPA on progress of the RFI, presenting the proposed development plan and schedule, and presenting recommendations regarding the RFI Report submittal/review schedule and risk assessment.

The GSA-NCR and URS proposed deferment of conducting the risk assessment. Conducting a baseline risk assessment before construction would not accurately characterize risks to human populations and environmental systems because a large proportion of the impacted soil and groundwater would be removed from the DOT Parcel during foundation excavation. The risk assessment would more appropriately be a part of interim measures plans for construction of the DOT building. In an August 16, 2002 letter, the USEPA approved this approach to the risk assessment, provided health and safety measures are implemented during excavation to protect sensitive human populations (e.g., construction workers, SEFC workers and visitors, and the public) and environmental systems. The USEPA approved approach also dictates that soil risks posed by soil contaminants will be kept as separate assessments for the DOT Parcel and SEFC, but that the SEFC RFI shall include an assessment using all groundwater data (i.e. those from the DOT Parcel are included). Please refer to Sections 5 and 6 for further information concerning the deferment of the Risk Assessment.

A schematic design description dated July 10, 2002 indicates that the excavation will extend from about 50-feet south of M Street, S.E. in the north to about 40-feet north of Building 167 in the south and from Fourth Street, S.E. in the east to New Jersey Avenue, S.E. in the west, an area approximately 800 feet by 270 feet (Figure 2-3). The excavation reportedly will be approximately 25 to 30-feet deep. This equates to approximately 210,000 cy of soil to be removed and properly disposed offsite.

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3.1.2 Field Investigations and Equipment

As specified in the FSP and QAPP, field equipment were field calibrated in accordance with manufacturer's recommendations (Appendix E) and vendor documentation indicating calibration checks were obtained (Appendix F). Also, quality assurance documentation that was enclosed with supplies used in well construction (well screen, sand, bentonite, drilling mud), sample collection (sample equipment decontamination chemicals, EnCoreTM samplers), and sample preservation (sample containers) was retained and is included in Appendix F.

In order to facilitate the collection of representative groundwater samples and remove sediment and stagnant water from monitoring wells, all newly installed monitoring wells were developed and all pre-RFI monitoring wells were re-developed in accordance with the FSP. Records of well development/re-development are included in Appendix G. After the wells were developed/re-developed, they were allowed to stabilize and equilibrate in accordance with the FSP. Following stabilization and equilibration, wells were sampled using the low-flow sampling technique described in the FSP. Records of groundwater quality measurements are included in Appendix H, demonstrating that representative (stable water quality readings and well drawdown) groundwater conditions were obtained prior to collecting samples.

In accordance with the FSP, all soil borings and monitoring wells installed to meet objectives described in Section 2 of the FSP (Figure 1-3) were surveyed by a professional land surveyor. Also, as specified in the FSP, all existing monitoring well locations were also surveyed. Since the locations of previous soil borings, HydropunchTM borings, well-points, and remediation confirmation samples could not be easily located on the ground, their locations were approximated based on location maps prepared by each consultant and included in their respective report.

3.1.3 Laboratory Data

Soil samples collected to meet the objectives listed under each AOI in the FSP were analyzed for one or more of the following suites of compounds/analytes:

- Appendix IX Inorganics – excluding cyanide and sulfide (AP IX IC); soil samples - 66 primary samples, 8 duplicate samples, 5 rinse blank samples, and 3 matrix spike/matrix spike duplicate (MS/MSD) samples; groundwater – 42 primary samples, 4 duplicate samples, 2 rinse blank samples, and 2 MS/MSD samples;
- Appendix IX Volatiles plus Methyl tert-butyl ether (AP IX VC); soil samples – 64 primary samples, 8 duplicate samples, 5 rinse blank samples, 3 MS/MSD samples, and 13 trip blank samples; groundwater – 42 primary samples, 4 duplicate samples, 2 rinse blank samples, 2 MS/MSD samples, and 7 trip blank samples.
- Appendix IX Semivolatiles (AP IX SVC); soil samples – 68 primary samples, 8 duplicate samples, 5 rinse blank samples, and 3 MS/MSD samples; groundwater – 42 primary samples, 4 duplicate samples, 2 rinse blank samples, and 2 MS/MSD samples.
- Appendix IX Organochlorine Pesticides – PCBs only (AP IX OP); soil samples – 52 primary samples, 8 duplicate samples, 5 rinse blank samples, and 3 MS/MSD samples.
- TPH product identification; groundwater – 1 primary sample.

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Table 2-1 of the October 18, 2002 comment response letter (URS, 2001c) includes the analytical schedule for all RFI samples collected on the DOT Parcel that were proposed to be sampled in the FSP. Sediments collected from storm water catchment structures and soils from the three related shallow soil borings (BC-SB09, BC-SB10, and BC-SB11) were analyzed for AP IX OP. In addition, the soil samples collected from soil borings G2-SB/MW04, G2-SB/MW05, and G2-SB/MW06 were analyzed for AP IX VC and AP IX SVC.

All groundwater samples collected were analyzed for AP IX IC, AP IX VC, and AP IX SVC.

The DCC&IM/SS (URS, 2001a) and SI (URS, 2001b) present detailed discussions on the use history and past activities conducted within each AOI. Summaries of previous investigations conducted within each AOI boundary are also presented. The rationale for conducting the sampling and analyses in each AOI, and the objective of each investigation is presented in the FSP and is summarized in respective sub-sections of Section 4.

One hundred percent of RFI AP IX IC, AP IX VC, AP IX SVC, and AP IX OP data were validated by URS staff in accordance with the procedures specified in the following:

- “Region III Modifications to Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses”, USEPA Region III Central Regional Laboratory Quality Assurance Branch, April 1993 (USEPA, 1993), and
- “Region III Modifications to National Functional Guidelines for Organic Data Review Multi-Media, Multi Concentration (OLMO1.0 - OLMO1.9)”, USEPA Region III Central Regional Laboratory Quality Assurance Branch, September 1994 (USEPA, 1994a).

While the data validation was not conducted by an independent party, the URS data validators were located in the Baltimore, MD office and had no other participation in the RFI.

Appendix I includes URS’ data validation reports for all site RFI sample analyses. The reports include a narrative of the validation findings, checklists used by the validation staff, and explanations of data qualifiers used. Laboratory data packages are not included in this report because of the extremely large quantity of data generated. However, Tables 3-6, 3-7a, and 3-7b include all laboratory reported data along with individual MDLs, reporting limits (RLs), laboratory qualifiers, and validation qualifiers. Appendix I also includes correspondence from one of the analytical laboratories that provides resolution to data reporting issues.

URS’ staff conducted a USEPA Level III Data Review on all RFI laboratory data, excluding those data associated with waste disposal characterization. Each data package received from the laboratories was subjected to the review process and a validation summary report was prepared for each data package. The review included checking the following for compliance with the QAPP and USEPA validation guidelines:

- Laboratory Deliverables – chain of custody records are accurate and complete, samples were appropriately packaged and preserved;
- Holding Times – verification that method prescribed holding times were not exceeded;
- Blanks – the appropriate number and type of blanks were prepared, handled, and analyzed;

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- Calibrations – initial and continuing calibrations were conducted and compounds were within calibration limits, appropriate standards were used for calibration;
- Instrument Performance Checks, Interference Checks – appropriate check and performance mixtures/samples were prepared and analyzed at the specified frequency, and were concentrations within limits;
- Surrogate Recoveries – correct surrogates were mixed with each sample, analyzed, and recoveries were within limits;
- Matrix Spike and Matrix Spike Duplicates, Digestion Spikes – spike and spike duplicates were prepared and analyzed at the required frequency and recoveries were within limits;
- Laboratory Control Samples – control samples were prepared and analyzed at the required frequency and recoveries were within limits;
- Duplicates – appropriate duplicates were collected/prepared and analyzed at the required frequency and results differences were within limits;
- Serial Dilutions – were they performed and were results within limits;
- Identification and Detection Limits – are positive compound identifications reliable and were appropriate detection limits used/achieved and reported; and
- Data Completeness – are data qualified appropriately and ready for use/interpretation.

Sample Analyses Quality Control

In accordance with the FSP and QAPP, quality assurance samples were prepared by the laboratory (trip blanks) or collected during field sampling activities (rinse blanks and field duplicates). Table 3-3 includes all RFI sample trip blank data, Table 3-4 includes all RFI sample rinse blank data, and Table 3-5 presents all RFI sample field duplicate data.

Trip Blanks

A total of 13 trip blanks were prepared and accompanied the shipping containers for RFI soil samples (Table 3-3). A total seven trip blanks were prepared and accompanied the shipping containers for RFI groundwater samples. AP IX VC target compounds were not detected above respective MDLs in any of the trip blank samples. Eighteen individual compound concentrations were qualified as rejected (qualifier “R”). Trip blank data indicate that the laboratory preparation procedures for packing and sending empty sample containers, the field sample packaging procedures, and the shipping procedures did not affect data quality.

Equipment Rinse Blanks

A total of eight sampling equipment rinse blanks were collected during RFI field sampling activities (Table 3-4). A total five rinse blanks were collected for soil sampling equipment, two for groundwater sampling equipment, and one for sediment sampling equipment.

AP IX OP target compounds were not detected above respective MDLs in any of the rinse blanks specifically tested for those compounds. One AP IX IC analyte, Zinc, was detected in three rinse blank samples, two associated with soil sampling (7 and 11 milligrams per kilogram (mg/kg) and

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one associated with groundwater sampling [22 mg/L]). The Zinc may be from the metal sampling equipment used. Three AP IX VC compounds were detected in one or more rinse blank samples. Acetone was detected in two soil sampling rinse blanks at concentrations of 11 µg/L and 12 µg/L, and in one groundwater sampling rinse blank at a concentration of 13 µg/L. The presence of Acetone would not be expected since it was not used for equipment decontamination and was not used or stored by URS on the DOT Parcel. Chloroform was detected in two soil sampling rinse blanks at concentrations of 5 µg/L and 7 µg/L. The presence of Chloroform would not be expected since it was not used for equipment decontamination and was not used or stored by URS on the DOT Parcel. Toluene was detected in one soil sampling rinse blank at a concentration of 6 µg/L. The presence of Toluene may be related to the use of gasoline powered vehicles in the vicinity of sampling activities. One AP IX SVC, 2,4,6-Trichlorophenol, was detected in both groundwater sampling event equipment rinse blanks at concentrations of 61 µg/L and 62 µg/L. Since this compound was detected at almost identical concentrations during two separate sampling events, two months apart, it is likely related to the direct-contact groundwater sampling equipment used (submersible pump, plastic coated electrical cable, and TeflonTM lined polyethylene tubing). However, this compound was not detected above the MDL of 1.76 µg/L in any RFI groundwater samples. Twenty individual compound concentrations were qualified as rejected (qualifier "R").

Sampling equipment rinse blank data indicate that equipment decontamination was accomplished without the introduction of contaminants at concentrations that would falsely elevate the concentrations of contaminants detected in primary samples.

Sampling Precision

A total of 13 field duplicates were collected during RFI field sampling activities (Table 3-5). A total eight were collected for soil sampling activities, four for groundwater sampling activities, and one for sediment sampling activities. The RFI Workplan goal for field sampling precision was for all field duplicate relative percent differences (RDPs) to be at or below 25% for both soil and groundwater samples. Of the RPDs that could be calculated (see Table 3-5), only 13 AP IX IC analyte analyses in five soil samples and one groundwater sample, five AP IX VC compound analyses in three soil and one groundwater sample, and one AP IX VC compound analysis in one soil sample, did not meet this criterion. Although the goal was not met for each compound analyzed, 81 percent of the RPD's did meet the goal (89 out of 110). Therefore, these data indicate that sampling precision is not likely to have affected results.

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Sample Data Completeness

A total of 27,377 individual compound/analyte results were generated and reported (2,142 AP IX IC, 9,106 AP IX VC, 15,730 AP IX SVC, and 399 AP IX OP). Of these, only 416 results were qualified as unusable (qualifier “R”) (18 AP IX IC, 216 AP IX VC, 182 AP IX SVC, and 0 AP IX OP). Therefore, the percent completeness is equal to 98%, which exceeded the RFI Workplan goal of 95%.

3.1.4 Use and Limitations

The data validation effort concluded that laboratory data generated from analyses of submitted samples could be used for both quantitative and qualitative purposes, with some data being subject to limitations of the qualifiers assigned to individual analytes/compounds. Individual analytes/compounds in a limited number of samples were qualified as unusable (qualifier “R”). Data were validated by staff employed by the same firm that collected the samples and received these data (URS), thus the validation was not an independent third party effort. However, the data validation staff did not participate in any data collection activities. One hundred percent of the RFI laboratory analytical data were validated.

3.2 VOLUNTARY REMEDIATION CONFIRMATION DATA

3.2.1 Laboratory Data

Table 3-8a includes data generated through the collection and analysis of post excavation soil samples from voluntary removal actions undertaken by the GSA-NCR. These data are represented by the sample identifications beginning with “SEFC/A1...”, “SEFC/G1...”, “SS-...”, “MS-...”, “TS-...”, and “TD-...”. Samples with sample identification beginning with “SEFC/A1...” were collected from September 1999 to March 2000. Samples with sample identifications beginning with “SS-...”, “MS-...”, “TS-...”, and “TD-...” were collected from November 1999 to March 2000. Data retained for the RFI process includes PCB analytical results. Samples beginning with “SEFC/G1...” were also analyzed for TPH, however, these data were excluded from further consideration as explained in Section 3. These data were not validated because the necessary laboratory QA/QC data packages were not available for review.

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3.2.2 Use and Limitations

These data may be able to be validated and thus could be retained for calculating risks to human populations and environmental systems. However, the laboratories that analyzed these samples would have to be contacted and requested to provide the necessary QA/QC packages, provided they are still available, and the laboratory's client that requested the analyses would have to be contacted and requested to allow release of the information. These data pertain to six areas of voluntary soil removal. Three of these areas, soil excavation areas G1, G2, and Building 232, are within the area to be completely excavated for the DOT building. Therefore, once the excavation is completed, the soil these data represent will have been removed from the DOT Parcel. One area, soil excavation, at Building 170, will be further investigated and remediated under the proposed IM for the DOT Parcel. Data pertaining to soil excavation area F1 consisted of TPH analyses, thus these data were excluded from this RFI Report. However, data are available in this RFI that pertain to the northern excavation face of this area. These data, collected as part of the RFI, should be used to represent this excavation area as a whole when conducting a risk assessment. The remaining area, excavation area A1, does not have data available that could be validated. However, the excavation confirmation samples, which were analyzed for PCBs, did not contain concentrations above the Applicable or Relevant and Appropriate Requirements (ARARs) for soil on this site (Section 4.1). Also, only one compound, Methylene Chloride, and two analytes, Arsenic and Chromium, concentrations were detected that exceed ARARs. The remaining ARAR exceedances are compounds that were reported as not detected but the MDL exceeds the ARAR. These data should be compared to the results of a risk assessment that excludes unvalidated data. If the inclusion of unvalidated data would increase the risk of the site soil as a whole, the concentrations of the parameters of interest should be confirmed by resampling and reanalysis.

3.3 WOODWARD-CLYDE FEDERAL SERVICES 1995 SOIL DATA

3.3.1 Laboratory Data

WCFS conducted a Phase II investigation in 1995 and published the results in 1996 (refer to the DCC&IM/SS for details of this investigation). Soil samples were laboratory analyzed for one or more suites of contaminants including metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and PCBs. Samples were also analyzed for TPH but these data were not retained for the RFI process (Section 3). Table 3-8a includes WCFS data retained for the RFI process, samples are represented by identifiers beginning with "SB-...". A comparison between the figure showing all WCFS exploration locations on the DOT Parcel (Figure 1-2) and the laboratory data included in Table 3-8a indicates that many locations do not have corresponding data retained for the RFI process. This is due to two reasons: 1) many of the samples collected were not submitted to the laboratory for analysis and 2) others were only analyzed for TPH (Table 3-2). All samples were screened using immunoassay techniques, however, only select samples were submitted to the laboratory for confirmation of results.

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3.3.2 Use and Limitations

All laboratory data generated by WCFS were validated to USEPA validation guidelines applicable in 1996. Data were validated by staff employed by the same firm that collected the samples and received these data (WCFS), thus the validation was not an independent third party effort. However, the data validation staff did not participate in any data collection activities. One hundred percent of the 1996 laboratory analytical data were validated. Therefore, these data from an analytical quality perspective could be used for calculating risks to human populations and environmental systems. However, a review of the sample depth intervals for the WCFS samples in Table 3-8a reveals that of the five samples retained, four are actually composites. Also, these data represent contaminant concentrations detected in soil more than six years ago. There is a high likelihood that VOCs and SVOCs may have undergone a significant degree of biodegradation. It is also likely that PCBs may have undergone biodegradation, although not to the degree of VOCs and SVOCs.

For these reasons, these data should not be used in assessing the maximum concentration of a contaminant in soil on the DOT Parcel. Also, data usability in a numeric risk assessment should be assessed by the individual risk assessor because concentrations are derived from composite, not discrete, samples and represent concentrations from more than six years ago. All laboratory data and data packages related to WCFS' 1996 investigation are available at URS' Gaithersburg, Maryland office.

3.4 KASELAAN & D'ANGELO ASSOCIATES, INC. 1991 SOIL DATA

3.4.1 Laboratory Data

Kaselaan & D'Angelo Associates, Inc. (K&D) conducted a Phase II investigation in 1991 and published the results in 1991 (refer to the DCC&IM/SS for details of this investigation). Soil samples were laboratory analyzed for one or more suites of contaminants including metals, VOCs, SVOCs, PCBs, and pesticides. Some samples were also analyzed for TPH but these data were not retained for the RFI process (Section 3). Table 3-8a includes K&D data retained for the RFI process, samples are represented by identifiers beginning with "KD..." and "MW..." K&D stated in their report that their data were not validated (K&D, 1991). Although laboratory narratives were included in K&D's report and are included with their laboratory reports of results (Appendix K), other laboratory QA/QC documentation is not available in order to be able to validate these data. Another data quality gap is MDLs are not documented in the laboratory reports or in K&D's report. Also, it is known that the laboratory which performed these analyses has been out-of-business for a number of years.

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3.4.2 Use and Limitations

The K&D data were not validated in 1991 and could not likely be validated because the necessary QA/QC data are not available for review and the laboratory which analyzed the samples is out-of-business. Therefore, these data from an analytical quality perspective could not be used for calculating risks to human populations and environmental systems. A review of the sample depth intervals for the K&D samples in Table 3-8a reveals that some of the retained samples are actually composites. Also, these data represent contaminant concentrations detected in soil more than 11 years ago. There is a high likelihood that VOCs and SVOCs may have undergone a significant degree of biodegradation. It is also likely that PCBs may have undergone biodegradation, although not to the degree of VOCs and SVOCs.

For these reasons, these data should not be used in assessing the maximum concentration of a contaminant in soil on the DOT Parcel and should not be used in a numeric risk assessment. Also, the use of composite sample data needs to be evaluated when utilizing some of these data.

3.5 APEX ENVIRONMENTAL 1990 SOIL DATA

3.5.1 Laboratory Data

Apex Environmental (Apex) conducted a Phase I investigation in 1990 and published the results in 1990 (refer to the DCC&IM/SS for details of this investigation). Soil samples were laboratory analyzed for one or more suites of contaminants including metals, VOCs, SVOCs, PCBs, and pesticides. Some samples were also analyzed for TPH but these data were not retained for the RFI process (Section 3). Table 3-8a includes Apex data retained for the RFI process, samples are represented by the identifier beginning with "A...". The Apex report (Apex, 1990) did not state that their data were validated and validation qualifiers were not presented in the report data tables. Laboratory narratives were not included in Apex's report. The laboratory data reports for Apex data retained are included in Appendix L. Other laboratory QA/QC documentation is not available in order to be able to validate these data. Another data quality gap is MDLs are not documented in the laboratory reports or in Apex's report.

3.5.2 Use and Limitations

Apex's data may be able to be validated and thus could be retained for calculating risks to human populations and environmental systems. However, the laboratories that analyzed would have to be contacted and requested to provide the necessary QA/QC packages, provided they are still available, and the laboratory's client that requested the analyses would have to be contacted and requested to allow release of the information. Therefore, these data from an analytical quality perspective should not be used for calculating risks to human populations and environmental systems. A review of the sample depth intervals for the Apex samples in Table 3-8a reveals that most of the retained samples are actually composites. Also, these data represent contaminant concentrations detected in soil more than 10 years ago. There is a high likelihood that VOCs and SVOCs may have undergone a significant degree of biodegradation. It is also likely that PCBs may have undergone biodegradation, although not to the degree of VOCs and SVOCs.

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For these reasons, these data should not be used in assessing the maximum concentration of a contaminant in soil on the DOT Parcel and should not be used in a numeric risk assessment. Also, the use of composite sample data needs to be evaluated when utilizing some of these data.

SECTION FOUR

RCRA Facility Investigation Results

The locations of samples for each AOI were selected based on known site conditions, documented historic activities, an interpretation of waste production and handling based on those activities, and previous sampling data. Figure 1-3 shows the RFI sampling locations for each of the AOIs. The following subsections discuss the analytical results for the sample locations from the RFI and previous investigations in each AOI. The investigations previously conducted for the SEFC and actions conducted to remove contamination or stabilize the site are described in the DCC&IM/SS report (URS, 2001a).

Throughout this section, discussions are presented in regard to RFI and previous soil constituent concentrations, and RFI groundwater constituent concentrations that exceed USEPA health-based risk screening levels (Section 4.1.1). These exceedances are graphically displayed on Figures 4-1 through 4-22. The data comparison methodology (Section 4.1.2) is based on USEPA guidance and accepted practices. This methodology resulted in many constituent exceedances being displayed on the figures and highlighted in tables, which may not actually be present in soil and groundwater. This discrepancy is due to the fact that for some constituents, the USEPA health-based risk screening levels are lower than the analytical method detection limits. However, the analytical methods used in this RFI are those prescribed by RFI regulations.

An example of this is Arsenic in soil. The lowest attainable MDL for Arsenic in soil in this RFI was 0.48 mg/Kg (Table 7-4 in the QAPP), however, the soil ARAR is 0.026 mg/Kg. Therefore, the reader is cautioned to not assume a contaminant is present merely because it is displayed on a drawing. The risk assessment process (Section Six) will evaluate whether or not these "possibly present" contaminants are likely to be present and therefore should be retained to evaluate the true cumulative increased risk site contaminants pose to human health and ecological receptors.

4.1 DATA EVALUATION METHODOLOGY

One hundred percent of all RFI laboratory data were subjected to a data validation process by URS. Once the validation process was complete, data were compiled and a Tier 1 Risk Assessment (hereafter referred to as assessment) was conducted. Table 3-6 presents the analytical results for the soil and sediment samples collected as part of the RFI. Tables 3-7a and 3-7b present the RFI analytical results for shallow groundwater zone samples and deep groundwater zone samples, respectively. Soil data from previous investigations were also included in the RFI assessment and have been compiled in Tables 3-8a and 3-8b. Several of the soil boring locations from the previous investigations have been removed from the figures due to excavation of contaminated soil. Therefore, only boring locations with laboratory results from soil that still exists onsite are presented in this report. Figure 4-17 shows the previous sampling locations retained for the RFI process.

4.1.1 Health Based Risk Standards Used for Data Comparison

The USEPA has established health-based screening levels known as Risk Based Concentrations (RBCs) and soil to groundwater Soil Screening Levels (SSLs), for many carcinogenic and noncarcinogenic compounds and analytes. RBCs and SSLs are intended for screening purposes; they are not intended to be clean-up levels. The most recent published RBCs and SSLs (October 9, 2002) available at the time this report was published were used in the Tier 1 Risk Assessment performed on the data reported from samples of groundwater, sediment, and soil on the DOT

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Parcel. For the purposes of this report, the three sets of RBC levels used to perform the assessment are tap water (for groundwater sample results), and industrial and residential soil levels. The SSLs (with a dilution attenuation factor of 20) used in the assessment are applied to soil. As discussed in Section 4.1.2, ARARs were developed from the RBCs and SSLs. The ARARs for tap water are listed in Tables 3-7a and 3-7b, along with the analytical results for shallow groundwater zone samples and deep groundwater zone samples, respectively. ARARs for soil levels are listed in Table 3-6 along with the analytical results for the soil and sediment samples collected as part of the RFI.

4.1.2 Data Comparison Methodology

The RFI analytical results and analytical results from previous investigations were reviewed and “flagged” as potentially impacting the soil, sediment, or groundwater if a particular reported concentration exceeded the respective ARAR. The constituents that exceeded ARARs are shown in Tables 3-6 (RFI soil and sediment), 3-7a & 3-7b (RFI groundwater), and 3-8a (previous soil). Figures 4-1 through 4-16 display in plan view the constituents exceeding ARARs from the RFI sampling data. Figures 4-18 through 4-22 display in plan view the constituents exceeding ARARs from the previous sampling events.

URS adjusted the Risk-Based Concentrations (RBCs) for non-carcinogens to represent a Hazard Quotient (HQ) of 0.1 for constituents of concern for this RCRA Facilities Investigation (RFI). Furthermore, groundwater ARARs were determined using the lower of tap water RBCs or drinking water Maximum Contaminant Levels (MCLs). Tables 3-9a and 3-9b show the derivation of the ARARs for soil and groundwater that were applied to individual analytes and compounds in Tables 3-6, 3-7a, 3-7b, and 3-8a.

There are several steps involved in determining an ARAR for constituents in groundwater and soil. The first step is to determine the following:

- A. For water samples, determine if the MCL is less than the tap water RBC for carcinogenic compounds (“C” in the RBC table). If so, compare data to the MCL, if not use the tap water RBC for comparison. Heretofore, the water comparison will be referred to as the “water RBC/MCL”. For non-carcinogenic tap water RBCs proceed to step C first.
- B. For soil samples, determine if the DAF 20 SSL is less than the residential and/or industrial soil RBC for carcinogenic compounds. If so, compare data to the SSL, if not use the lower of the residential or industrial soil RBC for comparison. Heretofore, the soil comparison will be referred to as the “soil RBC/SSL”. For non-carcinogenic soil RBCs or SSLs proceed to step C first.
- C. Once A. and B. have been determined, refer to the RBC table and determine if the water RBC and/or the soil RBC/SSL are non-carcinogenic (“N” in the RBC table) and need to be adjusted according to USEPA Guidance.
 - The tap water RBC for non-carcinogenic compounds must be divided by 10, then compare the adjusted value to the MCL. If the MCL is less than the adjusted tap water RBC, use the MCL for comparison, otherwise use the adjusted tap water RBC for comparison.

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- If the soil RBC/SSL is listed as a non-carcinogenic compound, divide it by 10 and use this adjusted value for comparison.

Once the ARAR values were established according to the above criteria, the RFI analytical results and analytical results from previous investigations were reviewed and “flagged” as potentially impacting the soil, sediment, or groundwater if a particular reported concentration exceeded the respective ARAR.

Guidance for evaluating chemical concentrations near the detection limit in risk assessments was obtained from the USEPA Mid-Atlantic Region Hazardous Site Cleanup Division (Smith, 1991). The comparison criteria used for the assessment of the RFI groundwater, soil and sediment data near the analytical detection and reporting limits are as follows:

1. If the constituent was not detected above the Method Detection Limit (MDL) in any sample in any sampled media and the corresponding ARAR is greater than the MDL, the result was assumed to be zero and no further comparison was conducted. These results are qualified with a “U” by the laboratory. The “U” indicates the constituent was not detected above the MDL and the associated Reporting Limit (RL) is the sample concentration necessary for the constituent to be quantitated. The MDL is the concentration above which a constituent may be identified, however, the concentration is estimated. The RL is the limit at which the concentration of the constituent may be accurately reported.
2. If a constituent was detected above the MDL during laboratory analysis, it was compared to the corresponding ARAR. If the reported concentration exceeded the associated ARAR, it was “flagged” and retained as a part of the assessment.
3. If a constituent in any media was not detected above the MDL (result qualified with a “U”) and one-half of the MDL was greater than the associated ARAR, it was “flagged” and retained as part of the assessment for all sampling locations.

URS did not have access to the MDLs applicable to data from previous investigations. In the absence of the actual MDLs, URS assumed the MDLs from RFI analyses applied to the previous data, therefore previous data MDLs are assumed MDLs. Also, previous data that were reported as not detected (“U,” or “ND,” or “BDL”) were interpreted to not be detected above the assumed MDL. There is a high likelihood that the MDLs used in this RFI report are lower than the true MDLs attained in the previous studies. This potential difference in the MDLs should not present an issue with the usability of the data because the RL must be 2 to 5 times the MDL, as specified by USEPA methods.

Constituents that were retained for further evaluation based on the third comparison criterion were further reviewed. In accordance with USEPA guidance (Smith, 1991), the following 25 compounds were eliminated from further consideration because they were not detected in any DOT Parcel sample media and the common manufacturing processes that produce these compounds were not known to have been conducted on the site. These compounds, and their common sources, are listed below:

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Volatile Organic Compounds

- 1,2-Dibromo-3-Chloropropane – soil fumigant and nematocide
- 1,2-Dibromoethane (EDB) – pesticide and gas additive
- Acrolein – aquatic herbicide and slimicide
- Acrylonitrile – acrylic production and plastics burning
- Bromodichloromethane – byproduct of water chlorination
- Dibromochloromethane – byproduct of water chlorination
- Dibromomethane – byproduct of water chlorination
- Methacrylonitrile – plastics and coatings production

Semi-Volatile Organic Compounds

- 1,3-Dinitrobenzene – used in explosives, dyes and plastics manufacturing
- 1,4-Dichlorobenzene – toilet bowl and garbage deodorant and fumigant for moth control
- 3,3'-Dichlorobenzidine – polyurethane production
- 3,3'-Dimethylbenzidine – dye, rigid plastics, and polyurethane-based high-strength elastomers production
- Acetophenone – shale oil processing and propylene oxide manufacturing
- Dinoseb – weed control, herbicide, and corn yield enhancer
- Hexachlorobenzene – byproduct of solvent production
- Nitrobenzene – aniline production and solvent for cellulose ether production
- N-Nitrosodiethylamine – specific information for this compound was not available, it is related to N-Nitrosodimethylamine and N-Nitroso-di-n-propylamine, which have been excluded from the assessment, and therefore was excluded from the assessment
- N-Nitrosodimethylamine – research chemical, rocket fuel production, and reactions involving alkylamines
- N-Nitroso-di-n-butylamine – specific information for this compound was not available, it is related to N-Nitrosodimethylamine and N-Nitroso-di-n-propylamine, which have been excluded from the assessment, and therefore was excluded from the assessment
- N-Nitroso-di-n-propylamine – research chemical, weed killers, and rubber product manufacturing
- N-Nitrosomethylethylamine – specific information for this compound was not available, it is related to N-Nitrosodimethylamine and N-Nitroso-di-n-propylamine, which have been excluded from the assessment, and therefore was excluded from the assessment

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- N-Nitrosopyrrolidine – specific information for this compound was not available, it is related to N-Nitrosodimethylamine and N-Nitroso-di-n-propylamine, which have been excluded from the assessment, and therefore was excluded from the assessment
- Pentachloronitrobenzene – herbicide, fungicide, and slimicide
- Pentachlorophenol – wood treatment for pressure treated wood

The following compounds and analytes were retained for comparison in this RFI Report since their detection or possible detection meet the comparison criteria set forth in criterion number two and/or criterion number three above, and common manufacturing processes that produce these constituents were conducted on the site.

Volatile Organic Compounds

- 1,1,2,2-Tetrachloroethane – This compound has been retained for both soil and groundwater assessments.
- 1,2-Dichloroethane – This compound has been retained for groundwater assessment only.
- 1,2-Dichloropropane – This compound has been retained for groundwater assessment only.
- 1,2,3-Trichloropropane – This compound has been retained for both soil and groundwater assessments.
- 1,4-Dichlorobenzene – This compound has been retained for both soil and groundwater assessments.
- Benzene – This compound has been retained for both soil and groundwater assessments.
- Carbon Tetrachloride – This compound has been retained for groundwater assessment only.
- Ethylbenzene – This compound has been retained for both soil and groundwater assessments.
- Methylene Chloride – This compound has been retained for soil assessment only.
- Methyl-tert-butyl ether – This compound has been retained for groundwater assessment only.
- Toluene – This compound has been retained for groundwater assessment only.
- Trichloroethene – This compound has been retained for both soil and groundwater assessments.
- Vinyl Chloride – This compound has been retained for groundwater assessment only.

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Inorganic Compounds (metals)

- Arsenic – This analyte has been retained for both soil and groundwater assessments.
- Chromium – This analyte has been retained for soil assessment only.
- Iron – This analyte has been retained for soil assessment only.
- Thallium – This analyte has been retained for soil and groundwater assessments.

Semi-Volatile Organic Compounds

- Benzo(a)Anthracene – This compound has been retained for both soil and groundwater assessments.
- Benzo(a)Pyrene – This compound has been retained for both soil and groundwater assessments.
- Benzo(b)Flouroanthene – This compound has been retained for both soil and groundwater assessments.
- Bis (2-Chloroethyl) ether – This compound has been retained for both soil and groundwater assessments.
- Bis(2-chloro-isopropyl) ether – This compound has been retained for soil assessment only.
- Bis(2-ethylhexly)Phthalate – This compound has been retained for groundwater assessment only.
- Dibenz(a,h)Anthracene – This compound has been retained for both soil and groundwater assessments.
- Indeno(1,2,3-cd)Pyrene – This compound has been retained for groundwater assessment only.
- Naphthalene – This compound has been retained for both soil and groundwater assessments.

Polychlorinated Biphenyls

- Aroclor 1260 – This compound has been retained for soil assessment only.

In summary, the USEPA data comparison methodology applied to RFI and previous investigation data where the ARAR is lower than the MDL has resulted in retaining 27 compounds and analytes, in addition to those reported as detected above the MDL, for further consideration of their distribution in site media and their possible impact on current and future receptors.

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As explained in Sections Five and Six, a risk assessment of current conditions will not be performed, rather one will be performed after the near future construction is completed, much of the contaminated media have been removed, and new site contaminant data are collected. Therefore, the 27 compound/analytes that have an ARAR that is less than their corresponding MDL and have been retained for further consideration in this RFI Report, should not be the same ones retained for the post constructing risk assessment. Rather the risk assessor must review all data for all media that remain and conduct a new data comparison similar to the one used herein.

4.2 RFI WORKPLAN AREAS OF INVESTIGATION

Details on the use history of buildings and former buildings within each AOI are included in the DCC&IM/SS and SI. The background and objectives presented below for each AOI are those stated previously in the FSP.

4.2.1 AOI-BC

4.2.1.1 Background

Former Building 153 was constructed between 1918 and 1919 and was known as Gun Shop 2. Various caliber gun barrels, ranging from 5-inch diameter (5 to 6 feet in length) to 16-inch diameter (30 to 40 feet in length) and associated gun breaches were machined, treated and repaired in this building (Apex, 1990). The blank barrels (rough cast and un-machined) were received via a railway from former Building 158. A shrinkage pit was located at the west end of the Gun Shop. This pit consisted of at least 12 individual compartments and elevators and was constructed of reinforced concrete. The pit structure (all 12 compartments and an elevator) is reported to be approximately 40 x 75 feet in plan dimension and believed to be between 80 and 100 feet deep. The shrinkage pit was used to heat gun barrels so they would expand and then liners were inserted into the gun barrels and the two-part assembly cooled with water to form an intact gun barrel assembly. K&D's Phase II ESA indicated that one large pit, a "shrinkage pit," was present at the west end of the building. Apex reported that the shrinkage pit was about 90 feet deep and about 35 x 68 feet in plan dimension (Apex, 1990). However, Apex indicated that the pit was located at the east end of the building. Historic photographs presented in the DCC&IM/ISS place the shrinkage pit at the west end of former Building 153.

Building 153 was demolished in 1974, therefore, no known building environmental investigations were performed. Information concerning activities related to possible building environmental issues are not available, or do not exist. Based on this information, the shrinkage pit is the primary area of concern. Metals and SVOCs associated with lubricating oils from the shrinkage operations are constituents of concern (COCs). Cleaning solvents used to clean metals are also COCs. Also, the machining activities conducted in the building may have produced COCs. Further, numerous electrical transformers were present in the building to operate the gun barrel immersion heaters. These transformers likely contained PCBs.

Previous investigations in this AOI have shown Cyanide (K&D, 1991 and WCFS, 1996) not to be a COC.

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A former bridge crane runway and forging yard (Crane Area 268 on Figure 1-3) existed north of Building 153 from post 1926 to post 1958. The crane likely moved gun barrels and other heavy items associated with gun production. COCs associated with the bridge crane runway would include metals and SVOCs resulting from oils that may have washed off metal items moved by the crane. The bridge cranes were most likely electrically operated based on the observation of electrically operated cranes inside other buildings (Buildings 160, 167, and 170) and former buildings (Buildings 158, 159, 159E, and 187) on the SEFC. However, the electricity appeared to have been fed from interior transformer vaults that were present or are present in the buildings mentioned previously. Therefore, PCBs are not likely to be a COC in the exterior Crane Area 268.

AOI-G is located within AOI-BC and will be discussed in detail in Section 4.2.4. Monitoring well G2-SB/MW03 was found to contain a free-floating oily product. The free product was identified as a heavy range fuel oil. SVOC contamination, particularly in soils, is sometimes associated with contamination from such fuel oils.

For the purposes of this discussion, AOI-BC extends to the north wall of Buildings 167, east to the eastern curblineline of 4th Street, S.E., and west to the east edge of former Building 216 (Figure 1-3). Storm drain sediment samples collected within AOI-BC as part of this RFI were tested for PCBs and are discussed in Section 4.2.6. PCB in soil investigations and remediations in former Building 232 and inside Building 170 are discussed in Section 4.2.8.

Former Building 205 was used as a metal storage area between 1941 until at least 1958. After 1958, Building 205 was used as a carpenter shop. Building 205 was demolished in 1999. As stated in the FSP, historical activities conducted inside Building 205 would be unlikely to have negatively impacted the subsurface. Previous investigations discussed in the DCC&IM/SS indicated that investigation of this area of AOI-BC was not necessary.

Soil samples were collected from six soil borings as part of the investigation of this AOI. Three of the soil borings (BC-SB/MW02, BC-SB/MW05, and BC-SB/MW07) were 80 to 85 feet deep. Soil samples for laboratory analysis were collected at 10-foot intervals. Laboratory soil samples at soil boring/well pair BC-SB/MW01 and BC-MW02 were collected from both locations rather than only at BC-SB/MW01 as indicated in the FSP. No split-spoon samples were collected in the shallow zone (0 to 40 feet BGS) at BC-SB/MW01. The shallow zone samples were instead collected from BC-MW02. Only laboratory samples at 40-feet BGS or deeper were collected from BC-SB/MW01 to a depth of 80-feet BGS. The shallow zone samples were collected from BC-MW02 instead of from BC-SB/MW01 in order expedite sampling. The wells in this well pair are located approximately 28-feet apart. Also, several additional split-spoon soil samples were collected to better define the subsurface lithology in the deep well boreholes. These additional samples were collected to better to define the top of the Potomac Clay layer and to locate water bearing zones in the Potomac group formation. However, these additional lithologic samples were not submitted for laboratory analysis.

Deep groundwater zone monitoring well BC-SB/MW01 was installed to a depth of 85-feet BGS instead of the 80-feet BGS specified in the FSP. BC-SB/MW01 was installed deeper than planned because the split spoon soil samples indicated that soils shallower than 80-feet BGS were composed of lean clay, a soil that would not likely produce sufficient water for groundwater sampling.

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BC-SB/MW08 was installed to a depth of 32-feet BGS instead of 40-feet BGS specified in the FSP. This was necessary because an obstruction was encountered at 32-feet BGS. Soil samples from BC-SB/MW08 were collected at 10-foot intervals.

All of the above soil samples were analyzed for the following parameters:

- AP IX IC,
- AP IX VC,
- AP IX SVC, and
- AP IX OP.

Six groundwater monitoring wells were installed and sampled twice. Groundwater samples were analyzed for the following parameters:

- AP IX IC,
- AP IX VC, and
- AP IX SVC.

Additionally, existing deep groundwater zone monitoring wells MW05, MW10, MW11, and MW12 and shallow groundwater zone monitoring wells MW03 and MW13 were sampled twice for the above parameters.

4.2.1.2 Investigation Objectives

The objective of sampling within this AOI was to investigate soil and groundwater for possible impacts from the reported shrinkage pit located at the west-end of former Building 153, the SVOC and PCB impact in soil previously reported, the current extent of VOC impact to groundwater previously reported, and also to investigate the current extent of the petroleum contamination (BTEX) believed to have migrated from the offsite former service station located northwest of the intersection of 3rd and M Streets S.E. Also, possible VOC, metal, and SVOC impacts associated with the former bridge crane runway and forging yard (Crane Area 268) were investigated. AOI-G is located within AOI-BC in the southeast corner of the area. Results of the investigation in AOI-G are presented in Section 4.2.4.

4.2.1.3 Investigation Results

2002 Results

Tables 3-6, 3-7a, and 3-7b summarize soil and groundwater data from the RFI. Quality Control data related to field sampling is summarized in Tables 3-3 through 3-5. Figures 4-13 through 4-16 show the analytical results and sample locations for these constituents that were detected, or are assumed to be, above ARARs in soil. Figures 4-1 through 4-12 show the analytical results and sample locations of groundwater constituents that were detected, or are assumed to be, above ARARs in rounds one and two. A number of the constituents listed on the figures are qualified with a "U." This indicates the constituent was not detected above the MDL, and the associated number is the concentration necessary to be quantitated. These constituents are shown on the figures due to the fact they were detected elsewhere on the DOT Parcel. Additionally, one half

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of the laboratory RL for these compounds is greater than the corresponding ARAR, therefore, according to USEPA guidance, these constituents should be considered for inclusion in a Tier 1 Risk Assessment.

Metals – RFI

The only AP IX IC constituents that were detected above respective ARARs during the investigation were Arsenic at three of the five soil sampling locations (BC-MW02, BC-SB/MW05, and BC-SB/MW08); Chromium and Selenium at all five soil sampling locations; Barium and Vanadium at one soil sample location (BC-SB/MW07); and Nickel and Silver at one soil sampling location (BC-SB/MW08).

Three Arsenic detections occurred in the uppermost soil sample (in all cases less than 7 feet deep) and one Arsenic detection was in the depth interval below the shallower sample (BC-SB/MW03 at 10 to 12 feet BGS). Although all three Arsenic exceedances were above the ARAR, only the detection at BC-MW02 (11 mg/kg) was above the arithmetic mean concentration for Arsenic in surface soils in the Eastern United States: 7.4 mg/kg (Shacklette, et al., 1984). The Chromium and Selenium exceedances were in samples from fill materials (depths up to 10-feet BGS), terrace deposits (10-feet to 42-feet BGS), and Potomac Group deposits (depths greater than 42-feet BGS). The Barium and Vanadium exceedances were in terrace deposits and Potomac Group deposits, respectively. Based on these observations, the Arsenic exceedances are likely associated with the fill materials and the Barium, Chromium, Selenium, and Vanadium exceedances are due to natural processes. The Nickel and Silver exceedances were at one location and in only one sampling interval (2- to 4-feet BGS at BC-SB/MW08). The Nickel exceedance was only 2% above the ARAR and the Silver exceedance was only 16% above the ARAR. It is apparent that these two exceedances represent an isolated area in the shallow fill materials.

The only detections of AP IX IC groundwater constituents above respective ARARs, in both rounds of sampling, in both the shallow and deep zones, were Arsenic and Barium. The Arsenic exceedances were in the shallow second round groundwater sample from BC-MW02 (7 µg/L) and in the shallow first round sample from MW13 (5 µg/L). The Barium exceedances were in the shallow first round groundwater sample from MW13 (290 µg/L) and in the deep first and second round samples from BC-SB/MW01 (560 µg/L and 720 µg/L, respectively). It is possible that water leaching through the soil in the vicinity of BC-MW02 (soil from BC-MW02 had the highest Arsenic level of any soil tested during the DOT RFI) is one likely source of the elevated Arsenic level in groundwater. The Barium exceedances are likely due to local and regional groundwater conditions since an exceedance was present in both the shallow and deep groundwater zones.

VOCs– RFI

Acetonitrile, Benzene, Ethylbenzene, and 1,1,1,2 Tetrachloroethane were the only AP IX VCs detected above ARARs in soil samples collected from AOI-BC. Additionally, 1,4 Dichlorobenzene (a chemical associated with raw sewage, moth balls, and toilet bowl deodorizer) was detected in a soil sample from monitoring well G2-SB/MW03 which is located in the southeast portion of AOI-BC.

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Acetonitrile exceedances were in samples of both the terrace deposits and Potomac Group deposits from locations BC-SB/MW05 and BC-SB/MW07. Since it was detected in non-human deposited soils, it is likely to be an artifact of the RFI field investigation, possibly related to the drilling mud ingredients used to drill these two borings. The Benzene exceedances were in three samples from location BC-MW02, one sample from BC-SB/MW05, and two samples from BC-SB/MW07. The Benzene is most likely to have originated from a remote source since it was not detected in soils shallower than 20-feet BGS. The shallow groundwater zone extends from approximately 20- to 40-feet BGS and it is within this depth interval that all of the Benzene and Ethylbenzene (30- to 32-foot BGS interval at location BC-MW02) exceedances were detected. This observation further supports the conclusion that the exceedances are most likely due to a remote, off-site, and upgradient source that has migrated in the shallow zone groundwater. The 1,1,1,2-Tetrachloroethane exceedance was in the 10- to 12-foot BGS sample from location BC-SB/MW07 and is most likely related to vehicle service and maintenance activities conducted in former Building 216. With the exception of Acetonitrile, all the above samples were collected in the terrace deposits with the exception of Benzene at 19 µg/kg in the 40-42 feet BGS sample from BC-SB/MW02. This sample was collected a few feet below the top of the uppermost Potomac Clay layer, and thus is well above the bottom of this aquitard.

BTEX (compounds associated with gasoline) was detected in shallow groundwater zone samples during both sampling rounds above respective ARARs in well BC-MW02. Benzene and Ethylbenzene concentrations above ARARs were also detected in both rounds of samples from shallow groundwater zone wells MW03 and MW13, and in the first round sample from shallow groundwater zone well BC-MW06. The highest concentrations of BTEX (Benzene at 4,470 µg/L, Toluene at 3,142 µg/L, Ethylbenzene at 1,180 µg/L, and total Xylenes at 3,532 µg/L) were detected in monitoring well BC-MW02 during the second round of groundwater sampling. Since Benzene and Ethylbenzene were only detected in soil samples associated with the shallow groundwater zone and the BTEX in shallow groundwater corresponds to locations where Benzene and Ethylbenzene were detected in soil. This observation further supports the conclusion that the BTEX contamination is from a remote and offsite source. Chloroform was detected above its ARAR in the first round sample from well BC-MW02 and in both samples from BC-SB/MW08. Although its detections were not labeled as possible laboratory blank contamination, it is a common laboratory contaminant. Also, Chloroform is associated with river water that has been chlorinated for drinking water purposes. Its presence in groundwater can be an indicator of a nearby leaking municipal water line. 1, 4 Dichlorobenzene was detected above its groundwater ARAR at a concentration of 10 µg/L in G2-SB/MW06 not far from the detection in soil at G2-SB/MW03. Results associated with AOI-G will be discussed in Sections 4.2.4 and 4.2.7 of this report.

Methyl-tert-butyl-ether (MTBE), an anti-knock gasoline additive, detected in BC-SB/MW01 during sampling round 1, was the only AP IX VC detected above an ARAR in the deep groundwater zone during either sampling round. MTBE was detected in this monitoring well at a concentration of 2.9 µg/L which is only 12% above the ARAR of 2.6 µg/L. It is possible that the MTBE has migrated along a preferential pathway that penetrates the upper clay confining aquitard. However, MTBE was not detected in the second round sample and was not detected in samples from shallow groundwater zone wells upgradient (BC-MW02 and BC-MW08) or cross-gradient (MW03) from BC-SB/MW01 (Figures 4-2 and 4-8).

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Historical data indicate that the BTEX detections and ARAR exceedances are likely the result of gasoline contamination believed to have migrated from the offsite former service station located at the northwest corner of the intersection of 3rd and M Streets S.E. Although the groundwater flow direction is currently towards the west and northwest, it has in the past been shown to be flowing from 3rd Street, SE to the south and southwest (refer to the DCC & IM/SS for this historical information and K&D, 1991). This former service station is on DC-DOH's leaking underground storage tank list. The presence of MTBE, which has been added to gasoline since the mid to late 1970s, is further evidence that the source of the BTEX contamination is from a former service station. However, it is possible, but highly unlikely, that onsite disposal practices could be a second source of some of the BTEX contamination present.

Handex, Inc. of Odenton, Maryland has been conducting monitoring of wells located at the former service station north of AOI-BC and one well located in the DOT parcel (MW03) from 1990 to the present. The following is a summary of data from Handex's groundwater monitoring activities:

Well	Benzene High and Current (µg/L)	Toluene High and Current (µg/L)	Ethylbenzene High and Current (µg/L)	Xylenes High and Current (µg/L)	Comments
MW-2/ VE-2	62 – 07/01/90 ND(2) – 09/09/02	11 – 07/01/90 ND(5) – 09/09/02	101 – 07/01/90 ND(5) – 09/09/02	264 – 07/01/90 ND(10) – 09/09/02	Not sampled since 09/09/02
MW-03	2,700 – 01/01/92 ND(2) – 06/05/03	1,800 – 03/01/91 ND(5) – 06/05/03	1,200 – 01/01/02 ND(5) – 06/05/03	3,700 – 01/01/92 ND(10) – 06/05/03	
MW-3/ OW-03	3,400 – 12/01/96 450 – 06/05/03	6,900 – 12/01/96 410 – 06/05/03	1,230 – 06/02/01 350 – 06/05/03	4,020 – 06/01/98 790 – 06/05/03	Well installed in 1996
MW-4	5 – 07/01/90 ND(2) – 09/09/02	5 – 07/01/90 ND(5) – 09/09/02	5 – 07/01/90 ND(5) – 09/09/02	5 – 07/01/90 ND(10) – 09/09/02	Not sampled since 09/09/02
MW-5/ VE-5	3,900 – 04/01/92 1,400 – 06/05/03	2,000 – 04/01/92 190 – 06/05/03	4,100 – 06/05/03	3,450 – 09/15/00 2,100 – 06/05/03	
MW-6	2,900 – 03/01/91	684 – 12/01/90	462 – 12/01/90	2,200 – 03/01/91	Well removed in 1991
MW-6A	4,300 – 04/01/92 2,500 – 06/05/03	2,800 – 04/01/92 46 – 06/05/03	4,300 – 04/01/92 170 – 06/05/03	8,000 – 04/01/92 320 – 06/05/03	Well installed in 1991, 0.04 to 0.12 feet of product detected in 1991/1992
MW-7/ VE-7	2,850 – 12/01/90 ND(2) – 06/05/03	2,100 – 03/01/91 ND(5) – 06/05/03	1,800 – 03/01/91 ND(5) – 06/05/03	4,700 – 03/01/91 ND(10) – 06/05/03	
MW-8/ RW-8	450 – 04/01/92 ND(2) – 09/09/02	98 – 04/01/92 ND(5) – 09/09/02	140 – 04/01/92 ND(5) – 09/09/02	220 – 04/01/92 ND(10) – 09/09/02	Well installed in 1992, not sampled since 09/09/02
MW-9/ RW-9	1,100 – 04/01/92 15 – 06/05/03	310 – 04/01/92 ND(5) – 06/05/03	490 – 04/01/92 ND(5) – 06/05/03	2,000 – 04/01/92 ND(10) – 06/05/03	Well installed in 1992
MW-10/	19 – 04/01/92 ND(2) – 09/09/02	2 – 04/01/92 ND(5) – 09/09/02	31 – 04/01/92 ND(5) – 09/09/02	87 – 04/01/92 ND(10) – 09/09/02	Well installed in 1992, not sampled

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Well	Benzene High and Current (µg/L)	Toluene High and Current (µg/L)	Ethylbenzene High and Current (µg/L)	Xylenes High and Current (µg/L)	Comments
RW-10					since 09/09/02
MW-11	Not detected	Not detected	Not detected	Not detected	Not sampled since 12/01/97, well destroyed after 06/06/02
MW-12/ RW-12	27 – 05/01/96 ND(2) – 09/09/02	6 – 05/01/95 ND(5) – 09/09/02	12 – 05/01/96 ND(5) – 09/09/02	11 – 05/01/95 ND(10) – 09/09/02	Well installed in 1992, not sampled since 09/09/02
MW-13	840 – 05/01/95 4 – 06/05/03	91 – 02/01/95 ND(5) – 06/05/03	380 – 02/01/95 9 – 06/05/03	1,000 – 02/01/95 14 – 06/05/03	Well installed in 1995
MW-14	7,160 – 06/01/97 6,700 – 06/05/03	1,620 – 06/02/01 910 – 06/05/03	4,600 – 06/05/03	9,970 – 06/01/97 9,500 – 06/05/03	Well installed in 1995

Data were obtained from Handex's July 28, 2003 "Quarterly Monitoring Report, April through June 2003, Former Shell Station, 212 M Street, SE, Washington, DC" which was prepared for the DC-DOH Underground Storage Tank Branch. There is no information indicating that these data have been subject to a data validation process. The following are limitations that were noted during review of these data:

- Wells were installed at different dates,
- MTBE was not analyzed for until the September 1, 1997 sampling event,
- The analytical method was changed to SW-846 Method No. 8021 beginning in 2002 which resulted in higher reporting limits than in previous analyses,
- Wells were not sampled between April, 1992 and February, 1995.

These data and other information contained in Handex's report indicate the following that support the conclusion that the BTEX contamination on AOI-BC is a result of the former service station:

- Well MW-11, which is upgradient of the former station, sampling results demonstrate that petroleum hydrocarbon contaminated groundwater is not migrating onto the service station site,
- BTEX contamination of groundwater is evident on both sides and to the east of the former pump island (wells MW-3/OW-3, MW-8/RW-8, and MW10/RW-10 north of the island, well MW-7/VE-7 is east of the island, and wells MW-2/VE-2, MW-5/VE-5, MW-6, MW-6A, and MW-9/RW-9 are south of the island),
- Wells MW-13 and MW-14 are installed in the median of M Street, SE and are hydraulically downgradient of the former station, MW-14 is hydraulically downgradient of the area where USTs and 1,400 tons of petroleum contaminated soil were removed,

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- The highest Benzene and Ethylbenzene concentrations to date are present in well MW-14 which is downgradient of the former leaking UST area, however, the highest Toluene and total Xylenes concentrations remain in well MW-6A which is installed in the former leaking UST excavation area,
- The fractionation of Benzene and Ethylbenzene (lighter and more soluble compounds) from Toluene and total Xylenes (heavier and less soluble compounds) and the hydraulic gradient between wells MW-6A and MW-14 demonstrate “classic” long-term (10’s of years) migration of BTEX from its source to a downgradient point,
- The highest concentration of MTBE detected (87 µg/L) was in the June, 2001 sample from well MW-3/OW-3, this well is north of the former pump island and UST excavation area,
- The highest concentration of MTBE reported in any of the offsite and downgradient wells is 61 µg/L in the March, 1998 sample from well MW-14, however, MTBE may be present but not reportable by the laboratory in recent samples (last five events) since the detection limits have been elevated (between 50 and 100 µg/L), and
- Liquid Phase Hydrocarbon (LPH) has only been reported in a well on the service station site (1991 and 1992 in well MW-6A).

SVOCs– RFI

No AP IX SVCs were detected at or above respective ARARs in RFI soil samples collected in AOI-BC. It should be noted that the bis (2-Chloroethyl) ether, 2,2’ Oxybis (1-Chloropropane, and Napthalene results shown on Figures 4-15A, 4-15B, and 4-15C were not detected above their respective MDLs. However, as one half the RL is greater than the ARAR, and this analyte was detected within the DOT Parcel, USEPA guidance requires these data be considered for inclusion in a Tier 1 Risk Assessment.

Bis (2-ethylhexyl) Phthalate, 2-Methylnaphthalene, and Naphthalene were the only AP IX SVCs detected in samples from the shallow groundwater zone above respective ARARs in AOI-BC. 2-Methylnaphthalene and Naphthalene are constituents of both gasoline and diesel fuel/fuel oil. 2-Methylnaphthalene was detected above the ARAR only in second round samples from monitoring wells BC-MW02 and MW13. Naphthalene was detected above the ARAR in both rounds of samples from monitoring wells BC-MW02, MW03, and MW13, and in all instances the concentrations were reported to be higher in round two samples. All three of these wells are within the historic petroleum hydrocarbon plume considered to have emanated from the offsite service station across M Street, S.E. Bis-(2-ethylhexyl) Phthalate was detected above its ARAR in the first round groundwater sample from MW13. This compound may be related the petroleum hydrocarbon plume also.

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Bis-(2-ethylhexyl) Phthalate was also the only AP IX SVC detected above respective ARARs in deep groundwater zone samples in AOI-BC (BC-SB/MW05 at a concentration of 36 µg/L). This compound is a plastic softener that is also produced by vehicle and industrial emissions and is commonly found in urban groundwater. Bis-(2-ethylhexyl) Phthalate is also a common laboratory contaminant. Its presence may be due to local groundwater chemistry acting upon the PVC well materials or possibly be a laboratory contaminant (although the laboratory and data validation effort did not qualify these detections as laboratory contaminants).

PCBs

Aroclor 1260 was the only AP IX OP detected above respective ARARs in any soil sample collected from borings/monitoring wells in AOI-BC. This compound was detected in the 1.5- to 3- feet BGS sample from location BC-SB/MW05 (0.5 ppm) and in the 2- to 4-feet BGS sample from location BC-SB/MW08 (11 ppm). These exceedances are most likely attributable to transformers associated with the historic activities conducted in former Building 153.

Previous Soil Investigation Data

A number of previous subsurface investigations have been conducted on the DOT Parcel (DCC&IM/SS). These investigations were conducted by Apex in 1990, K&D in 1991, and WCFS in 1996. Tables 3-8 and 3-9 summarize previous investigation and voluntary remediation laboratory test results. Figures 4-17 through 4-22 show the soil sampling locations and results above, or presumed to be above, respective ARARs for each of the previous investigations. Table 3-1 summarizes soil samples collected and analyses performed on samples from the three above investigations. A number of the constituents listed on the figures are qualified with a “U.” This indicates the constituent was not detected above the MDL, and the associated number is the concentration necessary to be quantitated. These constituents are shown on the figures due to the fact that the compounds were detected elsewhere on the DOT Parcel. Additionally, one half of the laboratory RL for these compounds is greater than the ARAR for the constituent, therefore, according to USEPA guidance, these constituents should be considered for inclusion in a Tier 1 risk assessment.

It should be noted that the concentrations of SVOCs, PCBs, and particularly VOCs would likely change over time due to degradation and volatilization (for VOCs and to a lesser extent SVOCs and PCBs). Thus, COC levels present during the previous investigation may now be lower.

In 1990, Apex drilled soil boring A5 in the north portion of AOI-BC near 3rd and M Streets, S.E. In 1991, K&D performed a Phase II investigation of the SEFC. The K&D borings included K&D12, K&D13, K&D18, K&D19, and K&D24. Two soil samples were also collected during the drilling of MW05 as part of K&D’s 1991 investigation. The deepest soil sample collected in any of the historical investigations or in the RFI was collected from the 105- to 107- feet BGS interval of MW05. WCFS drilled two soil borings, SB113 and SB114. The WCFS borings were in the northwest portion of AOI-BC.

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Metals

The previous soil analyses for inorganic compounds indicated that Aluminum, Arsenic, Chromium, Manganese, Iron, and Vanadium concentrations were present in soil at or above respective ARARs. Aluminum, Arsenic, Chromium, Iron, and Manganese exceedances are not considered to be attributable to human activities since there were exceedances present in terrace deposit samples (KD12B, KD13B, KD18B, KD189B, KD24B, and MW-05A) and in the only Potomac Group deposit sample (MW-05B). The Vanadium exceedance was in the shallow soil sample KD13A from location K&D13. However, the detected concentration of 55.6 ppm represents only a one percent exceedance of the 55 ppm ARAR.

VOCs

Benzene was detected above its soil ARAR in the 12- to 14-foot BGS sample collected from location K&D18. This was the only VOC ARAR exceedance in historic soil samples collected within AOI-BC with the exception of suspected laboratory contaminants discussed below. This soil boring is located within the petroleum hydrocarbon groundwater plume discussed in this section under VOCs-RFI. The Benzene exceedance is most likely attributable to this plume both due to the location and depth of the sample. The depth BGS of this sample is within the saturated zone of the shallow groundwater zone.

The VOC analyses performed on the Apex and K&D soil samples indicated that Methylene Chloride was detected in all samples collected in this AOI. Chloroform was detected above its ARAR only in the 105- to 107 feet BGS sample from location MW05. Methylene Chloride and Chloroform are common laboratory contaminants and are especially scrutinized when they are present in low concentrations (highest concentration was 560 µg/kg). Furthermore, the fact that Methylene Chloride was not present in the 1996 WCFS samples (those from SB113 and SB114) but was present in nearby samples from K&D12 is additional evidence of laboratory contamination. According to K&D's 1991 Phase II Subsurface Investigation Report, "targeted volatile organic compounds methylene chloride and acetone were present in nearly every soil and sediment sample and are attributable to field decontamination procedures and/or laboratory contamination" (Kaselaan & D'Angelo, Inc., 1991). Also, in reference to subsurface soil boring samples, "common field and laboratory contaminants methylene chloride, acetone, and to a much lesser degree 2-butanone and chloroform were present in the samples but were discounted since they were also present in the associated laboratory and field QA/QC samples" (Kaselaan & D'Angelo, Inc., 1991).

SVOCs

Benzo [a] anthracene, Benzo [a] pyrene, Benzo [b] flouranthene, and Diens [a,h] anthracene, all being PAHs, were all detected in the shallow (2- to 4- feet BGS) soil sample from location K&D19 at concentrations above respective ARARs. Naphthalene was also detected at a concentration above its ARAR in this same sample. The PAHs can result from leaching of creosote treated wood such as railroad ties as well as the burning of organic material (wood, rubbish, paper, coal). It is also possible that these SVOCs may have originated from ash and cinders in historic fill material. These COCs were not detected in soil samples from nearby RFI location BC-SB/MW05, as well as other borings installed in this AOI, indicating the presence of these COCs is isolated.

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PCBs

PCB (Aroclor 1260) was detected above the ARAR at a concentration of 0.96 mg/kg in the 2- to 4- feet BGS soil sample from K&D19. PCBs were not detected above MDLs in any other remaining historical soil samples collected in AOI-BC. The Aroclor 1260 was detected in the same shallow depth sample where the suite of PAHs (discussed above) were detected. The location and depth of this sample indicates that one likely source of the impact is historic activities conducted in former Building 153.

The objectives of the RFI within this AOI were to investigate soil and groundwater for possible impacts from the reported shrinkage pit located at the west-end of former Building 153, the previously reported SVOC and PCB impact in soil, the current extent of VOC impact to groundwater previously reported, and the current extent of the petroleum contamination (BTEX) believed to have migrated from the offsite former service station located northwest of the intersection of 3rd and M Streets S.E. Also, possible VOC, metal, and SVOC impacts associated with the former bridge crane runway and forging yard (Crane Area 268) were to be investigated. Based on RFI and previous data, the objectives were achieved.

4.2.2 AOI-BE

4.2.2.1 Background

Former Building 216, also known as the Supply House, was constructed within AOI-BE in 1944. Prior to its demolition in 1998, the building was used as a vehicle maintenance and motorpool area. Vehicle maintenance such as oil changes, tune-ups, and washing was performed. Vehicles were also stored in the building awaiting use. One sand-filter and four sets of vehicle hydraulic lift pits were located within this building.

A previous investigation of Building 216 conducted by K&D included sampling liquid in the wash-water sand filter for Target Analyte List (TAL) metals, SVOCs, and VOCs. Results indicated ten TAL metals with concentrations exceeding drinking water standards, SVOCs indicative of motor oil, and VOCs including Methylene Chloride, 1,1,1-Trichloroethane, and Acetone. The sand and commingled solids contained within the concrete sand-filter interceptor pit were removed by hand with a shovel. The removed sand and solids were then placed in 55-gallon drums for disposal. The drums were disposed of by a GSA contractor as general RCRA non-hazardous and TSCA non-regulated waste. The cleaned interceptor pit was then filled with sand and leveled (URS, 2001d). The soil in this area, designated as Area A-1, was excavated and disposed of offsite in September 1999.

During abatement and demolition of Building 216, URS investigated the vehicle hydraulic lift pits. Laboratory testing was performed on pit building materials as well as solids and liquids from the lift pits. A copy of the investigation report and laboratory analytical results is included in the DCC&IM/SS (URS, 2001a).

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Solid and liquid representative samples collected in and around the area of the vehicle lift pits in Building 216 did not contain chemical constituent concentrations above applicable regulatory waste disposal numeric criteria. Therefore, the wastes were disposed of as RCRA non-hazardous and TSCA non-regulated waste (demolition debris). The debris remaining in the hydraulic lift pits was removed using earthwork equipment. After laboratory analysis confirmed that the waste in the hydraulic lift pits and the pits themselves could be disposed of as demolition debris, the waste was disposed of as construction and demolition waste at a local landfill. The excavations remaining after the pits were removed were filled with sand and graded to the same level as the surrounding surface (URS, 2001d).

Two USTs were located in the vicinity of the northeast corner of Building 216, UST No. 4 and UST No. 5. UST No. 4, located north of the building, was removed in 1995. After removal, evidence of a petroleum release was observed and the District of Columbia Department of Health (DC-DOH) was notified of the release. In compliance with DC direction, the contractor removed contaminated soil down to the concrete pad located several feet below the bottom of the UST. The results of soil sampling conducted after the removal indicated detectable concentrations of BTEX in all 12 samples (benzene <1 ppb to 280 ppb, toluene <1 ppb to 110 ppb, ethylbenzene 1 ppb to 380 ppb, and xylene 7 ppb to 830 ppb). A comparison of these concentrations to October 5, 2000 EPA residential RBCs revealed that the maximum concentration detected for each BTEX constituent was below the respective RBC. TPH was not detected at a detection limit of 10 ppm in any of the 12 samples. Based on these results, GSA-NCR filed a Closure Notification Form and UST Closure Report with DC. After the tank and contaminated soil were removed, the excavation was backfilled with clean fill.

K&D collected subsurface soil samples from all four sides of the UST location in 1991 (sample locations T4-01, T4-03, T4-04 and T4-05), prior to the tank and soil excavation. These results indicated TPH levels below detection limit (BDL), however, the detection limit is not stated. Based on other UST soil sample results presented by K&D, TPH concentrations as low as 45 mg/kg were reported, thus it has been inferred that the reporting limit is at least as low as 45 mg/kg for BDL results. DC-DOH's regulatory level for TPH in in-place soils is 100 mg/kg. TPH concentrations above this limit indicate situations where excavation would be required. Based on these contamination indicator results and the filing of a UST Closure Report, further soil investigation in the area of UST No. 4 was not planned under the RFI.

UST No. 5 was located in the northeast corner adjacent to the east wall of the building. Records indicate that this tank had contained gasoline. K&D's 1991 sampling and analysis results indicated soil contamination in the vicinity of UST No. 5. In 1997, a GSA UST removal contractor attempted to remove UST No. 5. The contractor excavated in the location of UST No. 5 but did not uncover any UST. GSA-NCR and the removal contractor concluded that it had been removed; however, information has not been identified that documents the removal of UST No. 5.

K&D collected subsurface soil samples from four locations adjacent to the UST in 1991 (sample locations T5-01, T5-02, T5-06 and T5-07). These results indicated TPH levels below detection limit (BDL); however, the detection limit is not stated. Based on other UST soil sample results presented by K&D, TPH concentrations as low as 45 mg/kg were reported, thus it has been inferred that the reporting limit is at least as low as 45 mg/kg for BDL results. DC-DOH's regulatory level for TPH in in-place soils is 100 mg/kg. TPH concentrations above this limit

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indicate situations where excavation would be required. Based on these contamination indicator results, further soil investigation in the area of UST No. 5 was not planned under the RFI.

UST No. 6 was a 2,000-gallon waste oil tank located at the south end of Building 216. The tank was removed in 1997. After removal of the tank, evidence of a petroleum release was observed within the excavation. The DC-DOH was notified of the release. In compliance with DC-DOH direction, the removal contractor removed the majority of contaminated soil from the excavation as verified by confirmatory soil samples. Subsequent to the removal, GSA-NCR filed a Closure Notification Form and UST Closure Report with DC-DOH. K&D collected subsurface soil samples from four locations adjacent to the UST in 1991 (sample locations T6-01, T6-02, T6-03 and T6-04). These results indicated TPH levels below detection limit (BDL), however, the detection limit is not stated. Based on other UST soil sample results presented by K&D, TPH concentrations as low as 45 mg/kg were reported, thus it has been inferred that the reporting limit is at least as low as 45 mg/kg for BDL results. DC-DOH's regulatory level for TPH in in-place soils is 100 mg/kg. TPH concentrations above this limit indicate situations where excavation would be required. Based on these contamination indicator results further soil investigation in the area of UST No. 6 was not planned under the RFI. However, K&D and URS investigations from areas inside Building 216, immediately north of the former location of UST No. 6, revealed indicators of possible subsurface contamination by waste oil and vehicle service waste disposal activities. Therefore, the subsurface beneath Building 216 was investigated under the RFI.

Information pertaining to these USTs was obtained from the DCC&IM/SS report (URS, 2001a). UST Closure Reports for UST No. 4 and UST No. 6 are included in the DCC&IM/SS report.

The historical test results indicate that metals and TPH impact may be present in the subsurface due to the vehicle maintenance activities conducted in Building 216, particularly in the vehicle lift pits, and in the vicinity of the former USTs.

As part of the RFI, eight 25-foot deep soil borings were drilled within the footprint of former Building 216. Monitoring wells were installed in the shallow groundwater zone at four of the boring locations. Additionally, an 80-foot deep boring was drilled at the northeast corner of former Building 216 and a monitoring well was installed in the deep groundwater zone at this location (Figure 1-3). Split spoon soil samples were collected at 5-7, 15-17, and 25-27 feet BGS at each of the 25-foot deep borings. Samples were collected at 10-foot intervals (a total of 8 samples) in the 80-foot deep boring. All of the soil samples were analyzed for AP IX IC, AP IX SVC, and AP IX VC.

The first installation of monitoring well BE-SB/MW06 failed because prior to placing grout in the borehole above the bentonite pellet seal, the sand-pack had settled to a depth below the top of the well screen. A new borehole was drilled approximately 3-feet south and 5-feet east of the initial location. Monitoring well BE-SB/MW06 was then constructed at the offset location. Since the FSP specified soil samples had been collected at the initial location, none were collected during drilling at the offset location.

Two rounds of groundwater sampling were conducted as part of the RFI. Samples collected from the four shallow groundwater zone wells in AOI-BE and the deep groundwater zone well were submitted to the analytical laboratory and tested for AP IX IC, AP IX SVC, and AP IX VC.

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4.2.2.2 Objectives of Investigation

The objective of sampling within this AOI was to investigate soil and groundwater for possible impacts from the vehicle service and maintenance operations conducted in former Building 216, particularly in vehicle lift pits, and from operation of the three former USTs.

4.2.2.3 Investigation Results

2002 Results

Soil boring and monitoring well locations for AOI-BE are shown in Figure 1-3. Table 3-6 includes the laboratory results for the analyses of soil samples collected at the FSP specified depths. Laboratory results for groundwater samples collected during the FSP specified two rounds are included in Tables 3-7a and 3-7b. Site wide groundwater results and impacts are discussed in Section 4.2.5, AOI-GW.

Figures 4-13 through 4-15C display the analytical results for constituents that were assumed to be, or were, detected above ARARs in soils. Figures 4-1 through 4-12 display the analytical results for constituents that were assumed to be, or were, detected above ARARs in groundwater. A number of the constituents listed on the figures are qualified with a “U”. This indicates that the constituent was not detected above the MDL and the associated number is the concentration necessary to be quantitated. These constituents are shown on the figures due to the fact that the constituents were detected in at least one RFI sample or previous soil sample on the DOT Parcel. Additionally, one half of the laboratory RL for each of these compounds is greater than the corresponding ARAR, therefore, according to USEPA guidance, these constituents should be considered for inclusion in a Tier 1 risk assessment.

Metals– RFI

The AP IX IC analyses of the soil indicate Arsenic, Chromium, Selenium, and Vanadium were detected in AOI-BE above respective ARARs. Arsenic was detected at six boring locations, at varying soil sample intervals (not detected at locations BE-SB03 and BE-SB/MW06). Chromium and Selenium were detected at varying sample intervals at all eight boring locations. The Vanadium exceedance was in the 80- to 82-foot BGS sample from BC-SB.MW07. The same analysis was conducted for the two rounds of groundwater samples collected from the four shallow groundwater zone monitoring wells. Barium was detected (270 ug/L) above the ARAR during the first round of groundwater sampling from BE-SB/MW08. Thallium was detected (11 ug/L) above the ARAR in the round one duplicate groundwater sample from BE-SB/MW08.

At each location where Arsenic was detected above the ARAR in the soil in AOI-BE, the concentration was below 6.0 mg/kg. Arsenic is a naturally occurring constituent in the environment. The estimated arithmetic mean for naturally occurring background levels of Arsenic in the eastern U.S. is 7.4 mg/kg (Shacklette, et al., 1984). Arsenic was not detected in soil above this mean concentration in AOI-BE. All Chromium detections in soil were below the estimated arithmetic mean for naturally occurring background levels of Chromium in the eastern U.S., 52 mg/kg (Shacklette, et al., 1984). All detected concentrations of Selenium are above the estimated arithmetic mean for naturally occurring background levels of Selenium in the eastern U.S., 0.045 mg/kg (Shacklette, et al., 1984). However, since Selenium detections were at all

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three sample intervals (5-7 feet, 15-17 feet, and 20-27 feet BGS) and these intervals represent both fill and natural materials, and Selenium is not an expected contaminant based on the operations conducted in AOI-BE, its presence is likely due to natural rather than man-made processes. The one Vanadium exceedance was the only one detected in any of the AOI-BE soil samples collected during the RFI. Also, the depth at which the sample was collected (80-82 feet BGS) is in naturally occurring soils deposited before humans evolved on earth. Therefore, the exceedance is most likely attributable to natural processes.

Barium and Thallium were only detected in samples from one of two rounds of groundwater sampling and only in one of four monitoring wells. The Barium exceedance is only four percent (4%) above the ARAR. However, the Thallium groundwater exceedance is more than 10 times the ARAR. These two constituents were not detected in corresponding soils above respective ARARs, therefore, their presence is not likely due to operations conducted in this AOI.

VOCs – RFI

AP IX VCs were not detected above ARARs in soil at boring location BE-SB/MW08. At boring locations BE-BE-SB01, BE-SB/MW02, BE-SB/MW04, BE-SB05, BE-SB/MW06, and BE-SB07 Acetonitrile was the only AP IX VC detected above ARARs.

The AP IX VC analyses of soil indicate Acetonitrile, Benzene, and 1,1,1,2-Tetrachloroethane were detected above respective soil ARARs at boring location BC-SB/MW07. Acetonitrile, Acetone, Benzene, Ethylbenzene, and Toulene were detected above respective soil ARARs at boring location BE-SB03. Both of these borings are located in the northeast corner of former Building 216. The AP IX VC analysis for the two rounds of groundwater sampling indicated the following: Trichloroethene was detected above the groundwater ARAR in both rounds from BC-SB/MW02 and MTBE was also detected above its ARAR in both rounds of samples from BE-SB/MW04. The presence of BTEX compounds in the soil do not appear to be affecting the groundwater in AOI-BE. The samples collected from the shallow groundwater zone wells adjacent to the BTEX impacted soil, BE-SB/MW04 and BE-SB/MW02, do not contain BTEX compounds even above the MDL. BE-SB/MW04 and BE-SB/MW02 are located cross-gradient from the BTEX impacted soils, BE-SB/MW02 is also slightly upgradient.

The source of Benzene, Ethylbenzene, and Toulene in soil in the northeast corner of AOI-BE may be from a former gasoline station offsite and/or former gasoline USTs (Nos. 4 and 5) formerly located near the northeast corner of former Building 216. The DCC&IM/SS report (URS, 2001a) contains additional information regarding the former gasoline station and USTs. The detection of 1,1,1,2-Tetrachloroethane in soil and Trichloroethene in groundwater may be due to the use of industrial solvents for parts cleaning and degreasing for the care and maintenance of vehicles in former Building 216. These compounds may also be found associated with waste oil tanks. The detection of MTBE, a gasoline additive, in the shallow groundwater zone may be from gasoline that leaked from a UST, possibly former UST Nos. 4 and 5. Acetonitrile is produced by many industrial processes. It may be found in wastewaters from processes such as, but not limited to, coal gasification and the manufacture of plastics. This compound may also be found in emissions from car exhaust.

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SVOCs - RFI

The AP IX SVC analyses of the soil indicate Nitrobenzene was the only compound detected above soil ARARs. The detection was in the deep (25 to 27-foot BGS) duplicate sample from BE-SB03. The results for both rounds of groundwater sampling indicated AP IX SVCs were not detected in AOI-BE above respective ARARs. The soil exceedance was detected in a sample from terrace deposits and there were no exceedances in soil above the depth interval. Therefore, it is difficult to attribute the Nitrobenzene exceedance to a likely or suspected source.

Previous Soil Investigation Data

Previous subsurface investigations have been conducted on the DOT Parcel (URS, 2001a). The soil samples analyzed from AOI-BE during each of the previous investigations were collected outside of the footprint of Building 216 prior to its demolition. The soil borings drilled during the RFI were located within the footprint of former Building 216.

Previous investigations were conducted by Apex in 1990, K&D in 1991, and WCFS in 1996. Figures 4-18 through 4-21 show the soil sampling locations and results above, or assumed to be above, ARARs. A number of the constituents listed on the figures are qualified with a "U," "ND," or "BDL." This indicates that the constituent was not detected above the assumed MDL, and the associated number is the concentration necessary to be quantitated. These constituents are shown on the figures due to the fact that they were detected elsewhere on the DOT Parcel or, one half of the laboratory RL for these compounds is greater than the respective soil ARAR. Therefore, according to USEPA guidance, these constituents should be considered for inclusion in a Tier 1 risk assessment.

It should be noted that URS is interpreting that the constituents qualified with a "BDL," "ND," or "U" in these data are not detected above an assumed MDL. There is a high likelihood that the MDLs used in the RFI and applied to the previous data are lower than the MDLs used in the previous investigations. USEPA analysis methods specify that RLs must be 2 to 5 times MDLs. As a result, despite the fact that the true MDLs for the previous investigations may be higher, this should not present an issue with the usability of the previous data.

Apex 1990

In 1990, Apex drilled soil borings A1 and A3 outside of existing Building 216. These borings were located outside the west wall (southern half) and east wall (northern half), respectively. The soil analysis for inorganic compounds indicated Arsenic and Chromium are present in shallow and deep samples above the ARAR. Arsenic and Chromium are naturally occurring metals in the environment. Arsenic was detected at concentrations below 7.0 mg/kg and Chromium was detected at concentrations below 14.0 mg/kg in the Apex soil samples. The estimated arithmetic mean for naturally occurring background levels of Arsenic and Chromium in the eastern U.S. are 7.4 mg/kg and 52 mg/kg, respectively (Shacklette, et al., 1984). The VOC analysis performed on the Apex soil samples indicate Methylene Chloride is present above the ARAR in the shallow soil at location A1 (no deep soil sample was collected at this location). Methylene Chloride, a common lab contaminant, was detected in each Apex soil sample collected from the DOT Parcel, regardless of sample depth interval.

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K&D 1991

In 1991, K&D performed a Phase II investigation on the DOT Parcel. This investigation included drilling soil borings K&D08 and K&D09 outside of existing Building 216. These borings were located at the northeast corner (near former UST No. 4) and east wall (southern half) of the building.

The soil analyses for inorganic compounds indicated Arsenic, Aluminum, Chromium, Iron, and Manganese are present above their respective ARARs in the shallow and deep soil samples at both locations. Also, Thallium is present above its ARAR in the deep sample from K&D09. The detected Arsenic is at or below 7.1 mg/kg. This concentration is below the naturally occurring background level in the eastern U.S. of 7.4 mg/kg (Shacklette, et al., 1984). Additionally, the detected Chromium is at or below 25.5 mg/kg. This concentration is below the naturally occurring background level in the eastern U.S. of 52 mg/kg (Shacklette, et al., 1984). All of these constituents are likely associated with the fill material placed in AOI-BE.

The VOC analyses performed on the K&D soil samples indicated Methylene Chloride was present above the ARAR in the shallow and deep soil at both boring locations. This compound, a common lab contaminant, was detected in each K&D soil sample collected from the DOT Parcel, regardless of sample depth interval. The VOC analyses also indicated Ethylbenzene was present above the ARAR in the deep soil sample from K&D08. The sample depth interval where this compound was detected corresponds with the approximate depth of former gasoline UST No. 4.

The results of the SVOC analyses of the K&D soil samples indicate that Benzo [a] pyrene was present above the ARAR in the shallow soil sample at both locations. This compound may be produced by the combustion of coal or heavy oils. Naphthalene was also detected above the ARAR in the shallow soil sample from K&D09. Naphthalene is a common constituent in diesel fuel and #2 heating oil. The presence of this compound may be due to the vehicle maintenance and storage activities performed in former Building 216. Benzo [b] fluoranthene and Dibenz [a,h] anthracene were also detected above their respective ARARs in the shallow soil sample from K&D08. The presence of these compounds may be due to the vehicle maintenance activities performed in former Building 216, being constituents of oils, greases, and diesel fuel.

The K&D soil samples were also analyzed for PCB content. The analysis of the shallow and deep soil at K&D08 indicated Aroclor 1260 was detected above the ARAR, ranging from 0.59 to 0.94 mg/kg.

WCFS 1996

WCFS drilled two soil borings, SB112 and SB116, in AOI-BE during their 1996 investigation. The soil analysis for inorganic compounds indicate Aluminum, Chromium, Iron, and Manganese are present above their respective ARARs at both locations. Arsenic was detected above its ARAR at SB112. The detected level of Arsenic is below 1.0 mg/kg. This concentration is below the naturally occurring background level in the eastern U.S. of 7.4 mg/kg (Shacklette, et al., 1984). Additionally, the detected levels of Chromium are below 25.5 mg/kg. This concentration is below the naturally occurring background level in the eastern U.S. of 52 mg/kg (Shacklette, et al., 1984). These are the same suite of inorganics that were detected in the Apex samples, thus further supporting the conclusion that these constituents are inherent to the fill in AOI-BE.

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The SVOC analyses indicated Benzo [a] pyrene and Dibenz [a,h] anthracene are present at levels above ARARs in the soil sample collected at SB112. The analysis of the sample collected at SB116 indicate 1,4-Dichlorobenzene, Benzo [a] pyrene, Dibenz [a,h] anthracene, Naphthalene, and Nitrobenzene are present at levels above respective ARARs. Benzo [a] pyrene and Dibenz [a,h] anthracene may be produced during the combustion of coal ash or heavy oils. Naphthalene is a common constituent in diesel fuel and #2 heating oil. The presence of this compound may be due to the vehicle maintenance activities performed in Building 216 prior to demolition. 1,4-Dichlorobenzene and Nitrobenzene are common constituents in wastewater.

A review of RFI data and the results from the three previous investigations indicates Thallium was detected in the deep soil sample from K&D09 in 1991 and in the first round duplicate groundwater sample from BE-SB/MW08. Other constituents detected above ARARs in soil were not detected above ARARs in groundwater in AOI-BE. This indicates that the soil contaminants have not leached into the groundwater.

The objective of the RFI in AOI-BE, to investigate the impacts of vehicle maintenance and storage in former Building 216, and UST operations, was achieved. Many of the AP IX VC and AP IX SVC compounds that were detected above their respective ARARs are present in the materials used in the maintenance and care of vehicles.

4.2.3 AOI-F1

4.2.3.1 Background

AOI-F1 was the site of numerous railroad spurs prior to the 1960's (URS, 2001a). Previous investigations of AOI-F1 by WCFS indicated that soil in this block contained TPH above voluntary action limits determined by WCFS. As a result of the investigation, the soil in this area, designated Area F1 and shown on Figure 1-3, was excavated and disposed of offsite in October 1999. WCFS' 1995 investigation revealed a TPH exceedance in a sample from soil boring SB22 (2,100 mg/kg). Since the sample interval at SB22 extended below four feet in depth, soils requiring removal were assumed to extend one foot below the sample interval. In 1999, soil was removed at Area F-1 consisting of a 60-foot by 20-foot by 5.3 feet deep area. A total of 375.1 tons of soil were removed from this area and transported offsite for disposal. The Contractor indicated that an abandoned steam line was encountered during excavation. The Contractor removed the portion of the abandoned line that was in conflict with excavation activities and plugged the exposed ends prior to backfilling (URS, 2001a). Excavation confirmation soil samples indicated that TPH in excess of the WCFS-determined voluntary remedial action clean-up goal of 100 mg/kg for remaining soil remained at the north sidewall. The possibility exists that a leak or spill from a railcar may have been the source of the soil impact observed at excavation Area F1.

One 25-foot deep soil boring was drilled and a monitoring well installed in the shallow groundwater zone in AOI-F1 during the RFI. These activities were conducted north of excavation Area F1. The excavation location is shown on Figure 1-3. Split spoon soil samples were collected at depths of 5-7, 15-17, and 25-27 feet BGS. The soil from the boring was analyzed for AP IX IC, AP IX SVC, and AP IX VC.

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Two rounds of groundwater sampling were conducted as part of the RFI. Samples collected from the well in AOI-F1 were analyzed for AP IX IC, AP IX SVC, and AP IX VC.

4.2.3.2 Objectives of Investigation

The objective of sampling within this AOI was to further investigate petroleum impact and possible metals and VOC impacts to soil and groundwater at the north-end of excavation Area F1.

4.2.3.3 Investigation Results

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Split spoon soil samples were collected at depths of 5-7, 15-17, and 25-27 feet BGS in AOI-F1. Table 3-6 includes the laboratory results for the chemical analyses of each of the soil samples collected in the soil boring. A groundwater monitoring well was installed in the soil boring in the shallow groundwater zone and developed for groundwater sampling activities. Laboratory results for groundwater samples collected during two rounds of sampling are included in Table 3-7a. Site-wide groundwater results and impacts are discussed in Section 4.2.5, AOI-GW.

The analytical laboratory analyzed the soil samples collected in this AOI for AP IX IC, AP IX SVC, and AP IX VC. Chromium, Selenium, and Acetonitrile were the only constituents detected in soil collected within AOI-F1 that exceeded respective ARARs. Figures 4-13 through 4-15C display the analytical results for constituents detected, or assumed to be detected, above the respective ARARs for the boring in AOI-F1. The constituents qualified with a “U” are assumed to be detected above the ARAR for this investigation, therefore, according to USEPA guidance, these constituents should be considered for inclusion in a Tier 1 risk assessment.

Figures 4-1 through 4-6 show the analytical results for constituents detected above the ARARs and those not detected above the MDL but above ARARs in groundwater samples collected from the shallow zone groundwater monitoring wells. No constituents were detected above respective ARARs in either sample from well F1-SB/MW01. Those constituents not detected are qualified with a “U,” however, these compounds were detected elsewhere on the DOT Parcel. One half of the laboratory MDL for these compounds is greater than the ARAR, therefore, according to USEPA guidance, these constituents should be considered for inclusion in a Tier 1 risk assessment.

The soil represented by a boring that was installed in AOI-F1 during the investigation conducted by WCFS in 1996, SB22, was removed during the excavation of Area F1. After the excavation of Area F1 was complete, confirmation samples were collected. Analysis of the samples collected at the northern wall and the bottom of the excavation indicated TPH was present above voluntary action levels derived by WCFS. As a result, a liner was placed at this location prior to backfilling the excavation. The RFI soil and groundwater results in AOI-F1 for AP IX IC, AP IX SVC, and AP IX VC indicate no constituents indicative of TPH contamination are present in the soil or groundwater above the respective ARARs. The Chromium and Selenium are likely constituents that are inherent to the fill placed in the area of F1-SB/MW01 and underlying natural geologic materials. The Acetonitrile, occurring in the soil sample beneath the water table (25-25 feet BGS) but not in the sample at the water table (15-17 feet BGS) is likely to be an

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introduced contaminant (sampling, lab, or well-drilling contaminant) or an indicator of impact of subsurface utilities in the area (combined sewer, gas line, water line) since it was not detected elsewhere across the DOT Parcel and was not detected in groundwater. Thus, the remaining contamination in Area F1 in the northern wall and bottom of the excavation does not extend to soil at F1-SB/MW01 and has not impacted groundwater immediately adjacent to the northern wall of the excavation. Therefore, the objective of the RFI activity in AOI-F1, to investigate the impacts to soil at the northern wall of Area F1, was achieved.

4.2.4 AOI-G

4.2.4.1 Background

Previous investigations of AOI-G indicated that soil in the vicinity of former sample locations A6 and K&D25 contained TPH and PCBs above Residential RBCs. The shallow soil sample at A6 had a TPH concentration of 219 mg/kg and the deep sample had a TPH concentration of 2,090 mg/kg. These two TPH exceedances were from the 2.5 to 11 feet and 12 to 15 feet BGS sample intervals. These samples were located within the northern portion of Block G (Area G-2). The shallow soil sample at K&D25 had a PCB concentration of 5,000 µg/kg. This exceedance was noted at the sample depth interval of 1 to 3 feet BGS. This sample was located in Area G-1. The soil in these areas, designated as Areas G-1 and G-2, was excavated and disposed of offsite in October 1999 (URS, 2001a).

Proposed soil removal at Area G-1 consisted of a 60-foot diameter, 4-foot deep area. A total of 665.6 tons of soil were removed from this area and transported offsite for proper disposal. An existing electrical conduit was encountered during excavation activities and was supported by the excavation contractor. In addition, an existing concrete structure, possibly a grade beam associated with a previous building, was encountered during soil removal. This concrete structure was not removed during excavation activities.

Proposed soil removal at Area G-2 consisted of a 60-foot diameter area to a depth of 18 feet. A total of 3,220.7 tons of soil were removed from this area and transported offsite for proper disposal. It is noted that a portion of this contaminated soil removal area is coincident with Area G-1. In addition, a number of railroad ties were removed during soil excavation and disposed of offsite by Waste Management, Inc. Prior to excavation, the excavation contractor installed sheeting and shoring at the limits of the proposed excavations. An existing electrical conduit was encountered and supported by the Contractor during excavation activities (URS, 2001a).

Excavation confirmation soil samples indicated that TPH and PCBs in excess of residential RBCs remained at the bottom and north sidewall of Area G1 and TPH in excess of the voluntary remedial action clean-up goal, 100 mg/kg for remaining soil, remained at the north sidewall of Area G2. Also, a comparison of the constituents detected during previous sampling events to October 5, 2000 residential soil RBCs indicated that the concentrations of four SVOCs exceeded their respective RBCs at sample location K&D25, located in the middle of excavation G-1. Soil associated with this sample was removed during the voluntary excavation activity.

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SVOC, PCB, and TPH contamination may have been associated with historical activities associated with the operation of Building 153, as discussed in Section 4.2.1.

During the RFI fieldwork, PSH was discovered in monitoring well G2-SB/MW03. The PSH was identified as heavier than #2 fuel oil and may have been a heavy oil such as motor oil, hydraulic oil, or #6 fuel oil. Three additional shallow zone boring/groundwater monitoring wells were installed in the vicinity of G2-SB/MW03 to investigate the presence and extent of PSH. This section of the report does not discuss PSH related impact. PSH impact issues are discussed in Section 4.2.7.

Two soil borings (G1-SB01 and G1-SB02) were advanced to a depth of 10 feet BGS and soil was sampled during advancement at the 5 and 10-foot BGS intervals. The planned depth of these two soil borings penetrated the clean backfill placed in Area G1 and into the underlying historic fill (G1-SB01) and into the historic fill immediately north of Area G1 (G1-SB02). The two soil borings were sealed with grout upon completion. A third soil boring was advanced to a depth of 25-feet BGS and was sampled during advancement at 5-foot intervals (G2-SB/MW03). The planned depth penetrated the historic fill and underlying terrace sand and terminated near the top of a wedge of terrace clay beneath this portion of the DOT Parcel (refer to geologic cross-section A-A', Figure 2-4, in the DCC&IM/SS). As discussed above, due to the presence of PSH in monitoring well G2-SB/MW03, three additional soil borings/monitoring wells (G2-SB/MW04, G2-SB/MW05, G2-SB/MW06) were installed in the vicinity of G2-SB/MW03. Soil samples from borings G2-SB/MW04, G2-SB/MW05, G2-SB/MW06 were collected at 13-15 feet and 23-25 feet BGS. Soil borings G2-SB/MW03, G2-SB/MW04, G2-SB/MW05, G2-SB/MW06 were completed as 4-inch diameter groundwater monitoring wells.

Soil samples from G1-SB01 and G1-SB02 were analyzed for AP IX SVC and AP IX OP. Soil samples from G2-SB/MW03, G2-SB/MW04, G2-SB/MW05, and G2-SB/MW06 were analyzed for AP IX SVC and AP IX VC. Groundwater from all four monitoring wells was sampled and analyzed for AP IX VC, AP IX IN, and AP IX SVC.

4.2.4.2 Objectives of Investigation

The objective of sampling within this AOI was to further investigate PCB and SVOC impacts to soil at excavation Area G1 and petroleum hydrocarbon compound impacts to soil at the north-end of excavation Area G2. Also, possible metals contamination was investigated. As an additional RFI task, petroleum hydrocarbon constituent impact to soil and groundwater in the vicinity of G2-SB/MW03 was investigated. Petroleum hydrocarbon impact to groundwater is discussed in Section 4.2.7.

4.2.4.3 Investigation Results

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Tables 3-6, 3-7a and 3-7b summarize RFI soil and groundwater data. Quality assurance data related to field sampling are summarized in Tables 3-3, 3-4 and 3-5. Figures 4-13 through 4-16 show the analytical results and sample locations for the constituents that were detected above, or assumed to be detected, above respective ARARs for the soil samples collected in AOI-G. Figures 4-1 through 4-12 show the analytical results and sample locations of constituents that

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were detected, or assumed to be detected, above the groundwater ARARs. A number of the constituents listed on the figures are qualified with a “U.” This indicates that the constituent was not detected above the MDL, and the associated number is the concentration necessary to be quantitated. These constituents are shown on the figures due to the fact the compounds were detected elsewhere on the DOT Parcel. Additionally, one half of the laboratory RL for these compounds is greater than respective ARARs, therefore, according to USEPA guidance these constituents should be considered for inclusion in a Tier 1 Risk Assessment.

Metals – RFI

AP IX IC were not a COC in AOI-G. Thus, soils samples were not tested for AP IX IC. Barium was the only AP IX IC constituent detected above the MDL in groundwater samples collected within AOI-G.

VOCs – RFI

1, 4 Dichlorobenzene (a chemical associated with raw sewage, moth balls, and toilet bowl deodorizers), was detected above its ARAR at a concentration of 24 µg/kg in the 10 to 12 feet BGS soil sample from boring G2-SB/MW03. 1,1,1,2-Tetrachloroethane (an industrial solvent) was detected above its ARAR in the 23 to 25 feet BGS soil sample at a concentration of 5.9 µg/kg from boring G2-SB/MW04. 1, 4 Dichlorobenzene was detected above its ARAR in groundwater at a concentration of 10 µg/L in monitoring well G2-SB/MW06, upgradient from the detection in soil at boring G2-SB/MW03. The shallow groundwater flow direction (to the west) may indicate that the source of this compound may be from a leaking sanitary sewer line. Chloroform was detected above its ARAR at 10 µg/L in the groundwater sample collected from monitoring well G2-SB/MW05. Chloroform may be associated with industrial solvents as a production by-product and as an indicator of chlorinated drinking water. Based on the presence of 1,4-Dichlorobenzene (a chemical associated with raw sewage, moth balls, and toilet bowl deodorizers) in nearby groundwater and soil, the Chloroform is more likely to be from a leaking domestic water pipe.

SVOCs – RFI

AP IX SVC were not detected above the MDL in any soil samples collected from AOI-G. Furthermore, SVOCs were not detected above the MDL in any groundwater sample collected from monitoring wells in AOI-G.

PCBs – RFI

Aroclor 1260 was detected above its ARAR in soil samples from G2-SB02 at concentrations of 1.0 mg/kg in the 5 to 7 feet BGS sample, 2.4 mg/kg in the 10 to 12 feet BGS sample, and 2.7 mg/kg in the duplicate sample collected 10 to 12 feet BGS.. The presence of PCB in soil at this location may be the result of historical transformer usage in former Building 153.

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Previous Investigation Data

Previous subsurface investigations have been conducted in AOI-G. These investigations were conducted by Apex in 1990, K&D in 1991, and WCFS in 1996. Tables 3-8a and 3-8b summarize previous investigation and voluntary remediation confirmation sample results for soils. Figures 4-17 through 4-22 show the soil sampling locations and results above, or assumed to be above, ARARs for each of the previous investigations. Table 3-1 summarizes soil samples collected and analyses performed on previous investigation samples that were retained for this RFI. A number of the constituents listed on the figures are qualified with a “U”, “BDL”, or “ND.” This indicates that the constituent was not detected above the MDL, and the associated number is the concentration necessary to be quantitated. These constituents are shown on the figures due to the fact that they were detected elsewhere on the DOT Parcel. Additionally, one half of the MDL for these compounds is greater than their respective ARARs, therefore, according to USEPA guidance, these constituents should be considered for inclusion in a Tier 1 Risk Assessment.

It should be noted that the concentrations of SVOCs, PCBs, and particularly VOCs would likely change over time due to degradation and volatilization (for VOCs and to a lesser extent SVOCs and PBCs). Thus, COC concentrations present during the previous investigations may now be lower.

Previous investigation soil boring K&D25 is the only documented location where samples were analyzed for metals, SVOCs, and VOCs in AOI-G and where the soil was not removed. Contaminated soil excavation confirmation samples from Area G-1 are the only pre-RFI samples analyzed for PCBs in Area G1 and where the soil was not removed.

Metals

Arsenic, Chromium, and Iron were detected above their respective ARARs in a soil sample from boring K&D25. These analytes were detected in the 9 to 13 feet BGS sample (beneath the bottom of the G1 excavation). Arsenic and Chromium were detected above respective ARARs in both shallow (0 to 25 feet BGS) and deep (>25 feet BGS) soil samples from across the DOT Parcel. Iron, when it was a target analyte, was also detected above its ARAR in shallow and deep soil samples from across the DOT parcel. The presence of these three metals in soil in this AOI are believed to be representative of background concentrations in either the human-placed fill or naturally occurring soil deposits.

SVOCs

SVOCs were not detected in soil from K&D25 in the 9 to 13 feet BGS sample.

VOCs

Methylene Chloride was the only VOC detected above its ARAR in the 9-13 feet BGS soil sample from boring K&D25. It should be noted that Methylene Chloride is a common laboratory contaminant. Furthermore, the fact that Methylene Chloride was detected in numerous K&D samples collected throughout the DOT Parcel but was rarely, if it all, detected during the RFI or WCFS 1996 investigation is additional evidence that Methylene Chloride is likely a

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laboratory contaminant. Further, K&D stated in their report that the presence of Methylene Chloride in soil samples was likely due to laboratory contamination (K&D, 1992).

PCBs

The PCB concentration (0.6 mg/kg and 1.2 mg/kg duplicate sample) in contaminated soil excavation confirmation sample from the bottom of Area G-1 was the only pre-RFI PCB ARAR exceedance in AOI G.

4.2.5 AOI-GW

4.2.5.1 Investigation Background

Monitoring wells installed during previous investigations were last sampled in 1996, thus the current groundwater quality was not known. In order to perform the risk assessment specified in the RFI, the hydraulic properties of the geologic formations beneath the site and constituent impacts were evaluated under current conditions.

The locations of existing groundwater monitoring wells (those installed up through 1996) are shown on Figure 1-2. Locations of wells installed under the RFI are shown on Figure 1-3. Table 2-1 summarizes well depth and screened interval elevations for the 20 monitoring wells within the DOT Parcel. A discussion of the rationale for well placement and installation depth is included in the FSP and DCC&IM/SS..

The condition of existing wells installed on the site was performed in accordance with the FSP.

The site monitoring wells were developed and sampled in accordance with the FSP. RFI monitoring well development forms and groundwater sampling data forms are included in Appendices G and H, respectively. Groundwater levels were measured during each of the two quarterly rounds as described in the FSP.

4.2.5.2 Investigation Objectives

The objectives of conducting studies in this AOI were as follows:

- Investigate the condition of the existing site monitoring wells, properly abandon those that were found to be not functional (well casing blocked above the well screen or obstructions found within the well casing below the water level), and repair or replace those that were evaluated to be necessary to meet objectives of the RFI.
- Collect hydraulic testing data that were used to estimate the hydraulic conductivity of the water-bearing zones beneath the site.
- Collect water level data in DOT Parcel monitoring wells to evaluate groundwater flow directions.
- Collect data on groundwater constituent concentrations and water levels over the period of approximately two quarters to investigate temporal variations.

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4.2.5.3 Discussion of Results

Hydrogeologic Information

Hydrogeologic information is discussed in more detail in Section 2.2. The following discussion summarizes salient characteristics of DOT Parcel hydrogeology.

The hydrogeology in the vicinity of the site is characterized by the sandy units of the river terrace and Potomac group deposits. These sandy units are separated by the uppermost layer of Potomac group clays and silts which act as a confining aquitard resulting in two distinct water-bearing zones; the unconfined shallow zone and the confined deep zone consisting of Potomac group sands and silts. This is evidenced at shallow/deep well pairs MW10 and MW13, BC-SB/MW01 and BC-MW02; and BC-SB/MW05 and BC-MW06 where water levels in the deep wells are approximately 1.0 to 2.5 feet higher than water levels in their corresponding shallow wells. This aquitard ranges in thickness from 10 feet to greater than 40 feet over most of the site with the exception of south central and southwest portions of the site. Previous investigation boring logs indicate the uppermost Potomac Clay layer to be as thick as 2 feet in the south central and southwest portions of the DOT Parcel. Previous studies indicate that this aquitard, pinches out south of the DOT Parcel.

Depths to groundwater in the majority of the monitoring wells (both deep and shallow) place the groundwater at elevations from approximately 5½ feet above MSL to 5½ feet below MSL. Only three of the monitoring wells (BC-SB/MW08 and BE-SB/MW06) had water levels above MSL. Previous experience in the Washington, D.C. area indicates that groundwater levels and flow directions are closely associated with activities such as construction dewatering, building basement or parking garage dewatering, the location of Metro tunnels, or deep utilities, and are frequently found at depths below sea level. Specific activities thought to possibly affect both shallow and deep groundwater flow on the DOT Parcel are discussed in Section 2.2.1.

In general, the regional surface groundwater flow would be expected to be to the south, towards the Anacostia River, located south of the site. However, on the DOT Parcel, groundwater in the shallow zone flows towards the west and northwest. The groundwater flow direction in the deep zone is towards the west. Groundwater contour maps for the shallow zone are included in Figures 2-4 and 2-5, respectively. Groundwater contour maps for the deep zone are included in Figures 2-6 and 2-7, respectively.

Aquifer Testing Results

Slug tests were performed on selected monitoring wells in accordance with the FSP. Slug-test data are summarized in Table 2-3. Slug-test methodologies and rationales are discussed in Section 2.3.2. Slug-test data for both the falling and rising head tests were analyzed to calculate hydraulic conductivities (k). Results of the slug-test data analyses are summarized in Table 2-3. Hydraulic conductivity values interpreted from the slug-tests range from 2.04×10^{-5} to 3.73×10^{-3} centimeters/second (cm/s) for falling-head tests (insertion) and from 2.92×10^{-5} to 4.84×10^{-3} for rising-head tests (withdrawal), with geometric means of 2.24×10^{-4} for falling-head tests and 2.17×10^{-4} for rising-head tests. These values are consistent with typical hydraulic conductivity values for similar geologic materials in the Washington, D.C. area.

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A pump test was performed in accordance with the FSP. Pump-test data are summarized in Table 2-4. Pump-test methodologies and rationales are discussed in Section 2.3.2. The constant rate aquifer pumping test was conducted between July 22 and 23, 2002 utilizing well BC-MW06 as the pumping well. Water levels were monitored in selected surrounding wells within the DOT Parcel including BC-MW20, BC-SB/MW05, BC-MW18, BC-MW19, G2-SB/MW04, MW05, MW10, MW11, and G2-SB/MW06. The objective of the pump test was to provide information independent of the slug-tests necessary to characterize the hydraulic properties of the shallow groundwater zone and evaluate the interaction, if any, between the shallow and deep groundwater zones.

The results of the pumping phase and recovery phase of the constant-rate test are summarized in Table 2-4. The resulting hydraulic conductivity (k) is 1.66×10^{-5} cm/sec. The results of the pumping phase data indicate transmissivity (T) values ranging from $3.02 \text{ cm}^2/\text{sec}$ to $11.43 \text{ cm}^2/\text{sec}$. Based on an aquifer thickness of 40 feet, these values represent hydraulic conductivities ranging from 3.97×10^{-3} cm/sec to 1.50×10^{-2} cm/sec. These values range from two times to one order of magnitude greater than those calculated from the slug-test data. However, this discrepancy is not unexpected since slug-test results typically underestimate hydraulic conductivity. Transmissivity values interpreted from the recovery phase data range from $0.29 \text{ cm}^2/\text{sec}$ to $1.16 \text{ cm}^2/\text{sec}$. These values are in general 0.5 to 1 order of magnitude lower than those calculated from pumping phase data. The calculated hydraulic conductivities for the recovery phase ranged from 3.87×10^{-3} to 1.52×10^{-2} cm/sec. It should be noted that the results of the pumping and recovery phase data for some of the wells tested are believed to represent atmospheric effects and were therefore not used to calculate k and T values.

2002 Groundwater Flow Velocity

Using a derivation of the classic Darcy's equation, URS calculated the apparent groundwater flow velocity (flux) for both the shallow and deep groundwater zones. While using the derivation results in an approximate groundwater velocity, the values calculated represent, generally, an upper boundary of true groundwater velocity and are useful in assessing contaminant travel times from a source to the point of interest. The equation used is as follows:

$$V = ki$$

V = specific discharge or Darcy velocity

k = hydraulic conductivity

i = hydraulic gradient

The Darcy velocity for the shallow groundwater zone is 1.1×10^{-6} cm/sec (0.003 ft/day or 1 ft/year) using the average k derived from slug testing and 4.9×10^{-6} cm/sec (0.014 ft/day or 5 ft/year) using the average k derived from pump testing. The hydraulic gradient for the shallow zone was evaluated using wells G2-SB/MW03 and BC-MW02 (Figure 2-4). The head difference between these two wells is 3.81 feet (Round 2 groundwater elevations, Table 2-2) and the distance between them is approximately 775 feet (Figure 2-4). These parameters yield a hydraulic gradient of 4.9×10^{-3} . Based on this calculation the apparent groundwater flow in the shallow zone is expected to be between 1 ft/year and 5 ft/year.

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The Darcy velocity for the deep groundwater zone is 7.1×10^{-7} cm/sec (0.002 ft/day or 0.8 ft/year) based on the average k (5.1×10^{-4} cm/sec) for deep zone wells slug tested (BC-SB/MW05, BC-SB/MW07, MW-05, and MW-10). The hydraulic gradient for the deep zone was evaluated using wells MW11 and MW05 (Figure 2-6). The head difference between these two wells is 1.19 feet (Round 1 groundwater elevations, Table 2-2) and the distance between them is approximately 850 feet (Figure 2-6). These parameters yield a hydraulic gradient of 1.4×10^{-3} . A pump test of the deep zone was not conducted, therefore, a Darcy velocity could not be calculated based on pump test data.

2002 Groundwater Quality Results

AP IX ICs

Arsenic, Barium, and Thallium were the only AP IX ICs detected above respective ARARs in shallow groundwater zone samples within the DOT Parcel. Arsenic was detected at a concentration of 5 µg/L in the first round primary and duplicate samples from well MW13 and 7 µg/L in the second round sample from well BC-MW02. Thallium was detected at a concentration of 11 µg/L only in the first round duplicate sample from well BE-SB/MW08. Barium was detected during the first round of sampling in the duplicate sample from well BE-SB/MW04 (270 µg/L, primary sample concentration of 160 µg/L was below the ARAR) and in the primary sample from well MW13 (290 µg/L, duplicate sample concentration of 250 µg/L was below the ARAR). Thallium was also detected above the ARAR in the second round sample collected from well G2-SB/MW06 (260 µg/L, well was not installed for first round sampling event).

Since the exceedances are isolated and singular in nature, it is difficult to speculate as to their possible source, other than being derived from adjacent soils. Barium was detected in soil above the ARAR at one groundwater exceedance location but was detected in soil below the ARAR at the three other groundwater exceedance locations.

Barium was the only AP IX IC detected above a groundwater ARAR in samples from the deep groundwater zone monitoring wells within the DOT Parcel. This analyte was detected above the ARAR during both rounds of sampling from only one well, BC-SB/MW01, at concentrations of 560 µg/L and 720 µg/L, respectively. Barium was detected at or above its soil ARAR in all samples collected during the drilling of BC-SB/MW01.

AP IX VCs

Benzene and Ethylbenzene were both detected above respective ARARs in shallow zone monitoring well samples from BC-MW02, MW03, and MW13 during both sampling rounds and at BC-MW06 during the first sampling round. Toluene and total Xylenes were also detected above respective ARARs in groundwater samples from well BC-MW02 during both rounds of sampling. Further, detectable concentrations of Toluene and total Xylenes, although below respective ARARs, were reported in groundwater samples from well BC-MW06. The highest detected concentrations of Benzene (4,470 µg/L) and Ethylbenzene (1,180 µg/L) were associated with the second round groundwater sample well BC-MW02 (March 28-April 2, 2002) and the results were reported at a dilution factor of 100. Naphthalene (an AP IX SVC compound) was also detected in groundwater samples above its ARAR in samples from the same three wells

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discussed above, BC-MW02, MW03, and MW13. The highest Naphthalene concentration was 98 µg/L in the second a sample collected from well BC-MW02.

These exceedances were the only detections in groundwater (shallow and deep zones) of Benzene, Ethylbenzene, Toluene, total Xylenes, and Naphthalene on the DOT Parcel. All five of these COCs, when found together, represent petroleum hydrocarbon related contamination. All three wells are located historically-downgradient of the offsite former service station located north of the site that has a documented release of petroleum products. These wells are also within the historic petroleum hydrocarbon contaminant plume in the shallow groundwater zone (URS, 2001a). The most likely source of groundwater contamination detected in these monitoring wells is the offsite former service station located north of the property on the northwest corner of 3rd and M Streets S.E. (refer to Section 4.2.1.3, VOCs – RFI for further information).

Chloroform was detected above the groundwater ARAR in samples collected from BC-MW02 (round one), BC-SB/MW08 (rounds one and two), and G2 SB/MW03 (round two). The highest concentration was detected in the round one sample collected from well BC-SB/MW08, 16.86 µg/L. 1,4-Dichlorobenzene was detected in the round two sample collected from well G2-SB/MW06 at a concentration of 10 µg/L. Chloroform, a common laboratory contaminant, is also associated with industrial solvents as a production by-product and as an indicator of chlorinated drinking water. Based on the presence of 1,4-Dichlorobenzene (a chemical associated with raw sewage, moth balls, and toilet bowl deodorizers) in nearby groundwater and soil, the Chloroform and 1,4-Dichlorobenzene ARAR exceedances in the shallow groundwater zone is most likely due to a leaking domestic water supply pipe in AOI-G.

Trichloroethene (TCE) was detected above the groundwater ARAR at concentrations of 16 µg/L (first round) and 12 µg/L (second round) in shallow groundwater zone well BE-SB/MW02. TCE impact may be due to the use of industrial solvents for parts cleaning, and metal degreasing. Likely sources include the historic activities associated for former Building 216 or an isolated spill at, or in the vicinity of, BE-SB/MW02. It should be noted that TCE was detected in soils from BE-SB03. It is possible, given historical changes in shallow groundwater flow direction that impacted soils in the vicinity BE-SB03 could have been a source of groundwater impact detected in BE-SB/MW02. However, under current conditions, location BE-SB03 is diagonally upgradient of BE-SB/MW02 and well BE-SB/MW04 is directly upgradient (hydraulically). TCE was not detected in either of the groundwater samples from well BE-SB/MW04.

MTBE was detected above its groundwater ARAR in both samples collected from shallow zone well BE-SB/MW04. The detection of MTBE, a gasoline additive, in the shallow groundwater zone at BE-SB/MW04 may be due to the vehicle maintenance and storage activities performed in former Building 216, the former USTs at the northeast corner of former Building 216, or possibly, but less likely, from the offsite former service station. MTBE concentrations detected during rounds one and round two of sampling were 20 µg/L and 13 µg/L, respectively.

MTBE was the only AP IX VC detected above MDLs and an ARAR in the deep groundwater zone of the DOT Parcel. The detection, 2.9 µg/L, was only in the first round sample collected from deep well BC-SB/MW01 and represents an exceedance of the ARAR by only 12%. Since this compound was the only AP IX VC detected above an ARAR in groundwater beneath the confining Potomac Clay aquitard, it is apparent that this aquitard is preventing migration of

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contaminants from the shallow groundwater zone into the confined deep groundwater zone. Also, the MTBE detection is difficult to attribute to a likely or suspected source since it was not detected in the shallow groundwater zone above the aquitard.

AP IX SVCs

Bis (2-ethylhexyl) Phthalate, 2-Methylnaphthalene, and Naphthalene were the only AP IX SVCs detected above groundwater ARARs in shallow zone groundwater samples. Bis (2-ethylhexyl) Phthalate was only detected during the first round of sampling in well MW03; Naphthalene during both rounds of sampling in wells BC-MW02, MW03, and MW13; and 2-Methylnaphthalene only in second round samples from wells BC-MW02 and MW13. The following table summarizes these data:

Compound	Well Name	Sampling Round	Concentration Detected Above Groundwater ARARs
Bis (2-ethylhexyl) Phthalate	MW03	1	16 µg/L
Naphthalene	BC-MW02	1/2	81 µg/L/98 µg/L
	MW03	1/2	16 µg/L/48 µg/L
	MW13	1/2	21 µg/L, 16 µg/L (duplicate sample)/ 81 µg/L, 79 µg/L (duplicate sample)
2-Methylnaphthalene	BC-MW02	2	21 µg/L
	MW13	2	14 µg/L 13µg/L (duplicate sample)

These ARAR exceedances are likely related to the petroleum hydrocarbon contaminant plume believed to have originated from the offsite former service station property across M Street, S.E. (refer to Section 4.1.2.3 for further information).

Bis (2-ethylhexyl) Phthalate, at a concentration of 36 µg/L, was the only AP IX SVC detected above a groundwater ARAR in deep groundwater zone samples. This compound was detected in the first round sample from well BC-SB/MW05. Its presence may be due to local groundwater chemistry acting upon the PVC well materials or possibly be a laboratory contaminant (although the laboratory and data validation effort did not qualify these detections as laboratory contaminants).

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4.2.6 Investigation of Reported Polychlorinated Biphenyls (PCBs) in Storm Drain Sediments

4.2.6.1 Background

GSA is required to collect and analyze stormwater samples at regular intervals as a part of compliance with the National Pollutant Discharge Elimination System (NPDES) permit for the SEFC (WCFS, 1996b). During the first quarter of the year 2000, detectable concentrations of PCB were reported in samples collected during a stormwater sampling event. As a result, GSA requested the stormwater sampling contractor to collect and analyze sediment in catchment structures on the property. Stormwater sediment samples were collected in May and July, 2000. Concentrations of Aroclor 1260 were detected above 1 ppm in the majority of the samples.

In a September 19, 2001 teleconference, the GSA reminded URS that sampling and testing of sediments from storm water system catchment structures in the vicinity of Buildings 167 and 170 revealed detectable concentrations of PCBs. Building 167 is adjacent to the southern boundary of the DOT Parcel and Building 170 is within the southern portion of the DOT Parcel. GSA-NCR and URS agreed that sampling for PCBs in catchment structure sediments and surface soils should be included in the RFI. For this purpose, a total of nine samples were collected and analyzed as for AP IX OP. URS collected six sediment samples from various stormwater catchment structures and drilled three 3-foot deep soil borings to investigate the potential for PCB impact to surface soils in AOI-BC near stormwater catchment structures.

4.2.6.2 Objectives of Investigation

The objective of sampling for AP IX OP in stormwater associated sediments and shallow soils was to further investigate and confirm impacts of PCBs to storm drain sediment and surface soils on the DOT Parcel.

4.2.6.3 Investigation Results

URS collected stormwater catchment structure sediment samples from seven of the same locations sampled by the GSA-NCR contractor. These locations are within the DOT Parcel and are shown on Figures 1-3 and 4-16. The following table shows the previous sampling locations and the corresponding RFI sampling locations.

Previous Sampling Location	RFI Sampling Location
MH-35	BC-SB09 & BC-SD17
MH-24	BC-SD14
MH-32	BC-SD12 & BC-SB10
MH-31	BC-SD13
SD-37	BC-SD15
MH-37	BC-SD16
Southside of Building 170 (Beneath Metal Plates)	BC-SB11 (Former Transformer Location)

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The PCB results for the sediment and surface soils collected during the RFI are included in Table 3-6. Figure 4-16 shows the locations where PCBs were detected above ARARs during the RFI.

Aroclor 1260 is the only PCB detected above the MDL for both the previous and RFI sampling events. Aroclor 1260 was not detected above the MDL in any of the shallow soil borings, which were believed to be possible source areas. However, Aroclor 1260 was detected above the ARAR of 0.32 mg/kg at three sediment sampling locations. At location BC-SD17, it was detected at 1.0 mg/kg and in the duplicate sample for this location, the detected concentration was 0.9 mg/kg. The detected concentration was 0.4 mg/kg at location BC-SD15 and 0.6 mg/kg at location BC-SD12. Additionally, Aroclor 1260 was detected at 0.2 and 0.3 mg/kg at locations BC-SD13 and BC-SD16, respectively. However, these concentrations are below the ARAR.

Aroclor 1260 was detected in all of the samples analyzed during the previous investigation (May-July, 2000). The following list summarizes the results reported to GSA-NCR from the previous sampling event:

- MH-35 – The May 31st, 2000 result was 7.50 ppm and the July 31st, 2000 result was 12.40 ppm.
- MH-24 – No May 31st, 2000 result was provided and the July 31st, 2000 result was 27.50 ppm.
- MH-32 – The May 31st, 2000 result was 3.00 ppm and the July 31st, 2000 result was 7.68 ppm.
- MH-31 – No May 31st, 2000 result was provided and the July 31st, 2000 result was 3.67 ppm.
- SD-37 – The May 31st, 2000 result was 2.20 ppm and no July 31st, 2000 result was provided.
- MH-37 – The May 31st, 2000 result was 0.83 ppm and no July 31st, 2000 result was provided.
- Southside of Building 170 – No May 31st, 2000 result was provided and the July 31st, 2000 result was 1.31 ppm.

The results of the investigation indicate PCB impact to stormwater sediments is not as widespread as previously indicated. Additionally, the concentrations of Aroclor 1260 detected during the RFI are at or below 1 mg/kg (1 ppm). This result is lower than all but one of the concentrations reported during the previous stormwater sediment investigation for the DOT Parcel.

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4.2.7 Investigation of Phase Separated Hydrocarbon in Well G2-SB/MW03

The purpose of the study was to determine the actual thickness of the PSH in well G2-SB/MW03 and to evaluate the extent of impact by PSH and related constituents.

4.2.7.1 Investigation Background

URS was contracted by the GSA-NCR to perform additional environmental contamination investigations at the DOT Parcel. The GSA-NCR requested that URS conduct additional investigations related to the PSH discovered in the newly installed groundwater monitoring well G2-SB/MW03 during Round 1 of groundwater sampling (January 30 to February 1, 2002). Approximately 1-foot thickness of PSH was found to be present in the well at the time of sampling.

Components of the field investigation included a PSH bail down test and an investigation of the subsurface conditions in the vicinity of well G2-SB/MW03 using a Geonics Ltd. EM-61 (EM-61) high-resolution ground conductivity detector. Laboratory analysis was performed on a sample of the PSH to estimate its composition.

Three additional 25-foot deep soil boring/monitoring wells (G2-SB/MW04, G2-SB/MW05, and G2-SB/MW06) were installed in order to assess the extent of the PSH and petroleum constituent impact to soil and groundwater.

Soil samples collected from these wells during drilling were analyzed for AP IX VC and AP IX SVCs. Groundwater from these wells was also tested for AP IX IC, AP IX VC, and AP IX SVC. Results of these analyses are discussed in Sections 4.2.4 and 4.2.5.

4.2.7.2 Investigation Objective

The objective of this task was to assess the extent of the PSH in the subsurface, its impact to soil and groundwater, and to attempt to locate any unknown USTs in the immediate vicinity.

4.2.7.3 Investigation Results

Phase Separated Hydrocarbon Measurement and Identification

PSH measurements collected at monitoring well G2-SB/MW03 during the RFI field activities are summarized in Table 4-1. PSH was not detected in the surrounding groundwater monitoring wells G2-SB/MW04, G2-SB/MW05, and G2-SB/MW06 or in any other well during the RFI. Therefore, the extent of PSH is limited to the vicinity of G2-SB/MW03.

On March 8, 2002, a sample of the PSH was collected for chemical analysis and product identification. This sample yielded a distillate pattern heavier than diesel/no. 2 fuel oil such as No. 6 oil, hydraulic oil, and motor oil (Appendix Q).

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PSH Bail Down Test

URS performed a PSH bail down test in well G2-SB/MW03 on Feb 6, 2002. Monitoring wells are commonly used to determine the extent and thickness of PSH. It is recognized that the PSH thickness measured in the monitoring wells is only an apparent thickness, thought to be much greater than that of the actual thickness on the groundwater. There are two primary factors contributing to this phenomenon, specific gravity of the PSH and the height of the capillary fringe. If the measured apparent PSH thickness is greater than the actual formation PSH thickness, then at some point during the accumulation of PSH in the well bore, the apparent PSH thickness equals the actual PSH thickness.

The objective of the PSH bail down test was to evaluate the thickness of PSH in the subsurface. The results of initial gauging conducted within a few days of well development indicated approximately 1.1 feet (± 0.01 feet) of PSH existed above the static groundwater level in monitoring well G2-SB/MW03. On the day the bail down test was conducted, the PSH thickness had decreased to 0.5 feet. The bail down test is an accepted method of compensating for the apparent PSH thickness and provides a more realistic estimate of the actual PSH thickness in the soil formation.

Test Procedures

The following describes the bail down test and data analysis procedures. They are included in this report since they were not in the FSP.

1. Assemble necessary equipment and materials including an oil/water interface probe, bailer, bucket, stopwatch, log book and pen. Don required personal protective equipment.
2. Measure and record the stabilized water and PSH levels in the well.
3. Bail PSH and water from the well. Continue bailing until all PSH is removed from the well or until it reaches a constant thickness in the bailer after five bailer volumes are removed.
4. Upon completing bailing, recorded the rising water and PSH levels over time in accordance with the following schedule:

Elapsed Time (min)	Recording Frequency (min)
0-5	0.5
5-10	1
10-30	2
30-60	5
60-180	10
180+	As necessary to define slope.

5. Graph the water and PSH levels versus time.
6. Observe the slope of the water/PSH interface line and determine the inflection point.

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7. Based on correlation with nearby wells without PSH, calculate the true water level in the monitoring well tested, accounting for the difference in specific gravity between water and PSH.
8. Measure the difference between the PSH line and the water/PSH interface line at the inflection point (Step 6). This represents the actual PSH thickness in the formation.
9. Calculate the difference between the water/PSH interface level at the time of inflection and the stabilized top of PSH level. This is the sum of the actual PSH thickness and the capillary fringe.
10. Subtract the measurement in Step 9 from the measurement in Step 7 to calculate the height of the capillary fringe.

The results of the PSH bail down test are presented in Figure 4-23. The test was started February 6, 2002 and completed February 13, 2002. The results of the analysis of the PSH bail down test indicated that less than 0.01 feet of PSH was present on the groundwater surface in the vicinity of the well. This was estimated by procedures 1 through 5 only. Procedures 6 through 10 could not be completed due to inadequate PSH recharge.

Geophysical Investigation

The geophysical investigation consisted of an electromagnetic (EM) survey utilizing an EM-61. The EM-61 is specifically designed to detect buried metal objects. The instrument is ideal for locating USTs, piping systems, buried drums or other metal objects. The instrument is capable of detecting a single drum to a depth of up to 10 feet BGS. The method is advantageous over magnetic methods because the EM-61 is less affected by interference from surface features such as fences, buildings, or well casings.

The objective of the geophysical investigation was to locate potential sources of the PSH contamination. Possible PSH sources included, but were not necessarily limited to, undocumented USTs, buried drums, and abandoned fuel supply lines. However, it is also possible that the detected PSH may have resulted from historic undocumented surface spills.

Results of Geophysical Investigation

The results of the geophysical investigation are presented in Figures 4-24 and 4-25. On February 6, 2002 URS conducted a geophysical survey across an approximately 1.5-acre area nominally centered at monitoring well G2-SB/MW03. EM data were collected along transect lines spaced at 5-ft. centers across the entire area. Data were collected at a 2.5-ft. data station spacings along each transect line.

Figure 4-25 is a color-contoured map of the “bottom coil response” from the EM-61. The bottom coil response is most sensitive to near surface metallic objects. Figure 4-25 is a color-contoured map of the “differential response” from the EM-61. The differential response is the difference in readings from the two coils of the EM-61. This response tends to null-out readings from near surface metallic objects and allows depths to buried metallic objects to be estimated.

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Figures 4-25 and 4-26 show what is believed to be buried grade-beams (foundation system) and a portion of the foundation wall of former Building 153. The grade-beams are likely represented by the north-south trending, equally spaced anomalies north of well G2-SB/MW03. The building foundation south wall is likely represented by the east-west trending anomaly north of well G2-SB/MW03. Three other significant subsurface anomalies are believed to be present within the surveyed area. The first is the northeast trending anomaly originating from well G2-SB/MW03, the second is the north-south trending anomaly east of well G2-SB/MW03, and the third is the east-west trending anomaly southeast and southwest of well G2-SB/MW03. The third anomaly is estimated to be between three and five feet deep and is not present south of well G2-SB/MW03. The area south of well G2-SB/MW03 was excavated in 1999 during site soil remediation interim measures.

These findings do not indicate the presence of a subsurface anomaly that would be attributable to an underground storage tank, buried drum or other metallic object.

4.2.8 Building 170 and Former Building 232 PCB in Soil Voluntary Remediation

4.2.8.1 Background

Building 170, also known as the Electric Sub-Station, was constructed in 1919. The boiler room addition was built at a later time. The building consists of brick outer walls, metal beams, concrete diked areas, and gabled roofs made of copper and transite. Building 170 contains approximately 7,200 gross square feet of floor space. This building most recently was used to store transformers and drums of PCB containing transformer fluid prior to disposal. The building contained two sumps and an electrical feeder pit.

Former Building 232 was also known as the Metal Stores. The building construction consisted of a steel frame with steel siding on a concrete slab foundation. Building 232 contained approximately 5,030 gross SF of floor space. Prior to demolition in 1999, this building was used as an electrical shop (southern half) and had been renovated for the storage of drums of PCB-containing transformer oil removed from federal buildings throughout Washington, D.C. (northern half).

4.2.8.2 Objectives of Investigation

Data provided to URS by GSA-NCR indicated PCB contamination was present on and below surfaces of Building 170 and PCB-contaminated concrete was present in the northern half of Building 232. The objective of sampling beneath floor slabs at Buildings 170 and 232 was to evaluate if PCB-contaminated soil remained after the excavations beneath the demolition of floor slabs had been completed.

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4.2.8.3 Investigation Results

Nine concrete structures, possibly footers or portions of foundations, were encountered when the floor had been removed from the interior of Building 170. Concrete chip samples of these structures were collected to characterize the concrete and evaluate if removal was necessary. In areas where analytical results indicated concrete with PCB concentrations greater than 1 ppm, concrete was removed from the top of the structures. After removal of concrete from the top of the structures, chip samples were collected from each structure. This concrete removal and sampling procedure was repeated until analytical results indicated that concrete with a PCB concentration greater than 1 ppm had been removed. Areas adjacent to the west side of Building 170 were also designated to be excavated to remove PCB contaminated asphalt. Also, a transformer pad existed at the southwest exterior corner which was removed during the voluntary remediation.

Once the concrete and asphalt had been removed from the interior and exterior of Building 170, soil samples were collected from beneath each demolished surface area to characterize the underlying soil and evaluate if soil removal was necessary. In areas where analytical results indicated soil with PCB concentrations greater than 1 ppm, the USEPA voluntary spill clean-up level for soil, soil was excavated in 1-foot thick increments from those locations. After excavation at each PCB-contaminated sample location, soil samples were again collected from within the area to evaluate if PCB-contaminated soil remained. This excavation and sampling procedure was repeated until analytical results indicated that soil with a PCB concentration greater than 1 ppm had been removed. The following table outlines the extent and depths of interior and exterior soil excavations for Building 170.

Iteration	Area Excavated (feet north-south x feet east-west)	Sample Locations Covered in Area Excavated	Depth (feet)
1	9 x 32	2, 3, 4, and 5	1
2	61 x 32	SS-1, SS-2, and SS-3	1
2	20 x 32	SS-6	1
2	16 x 16	SS-10	1
2	20 x 32	SS-12	1
2	36 x 11	MS-2, MS-5, and MS-6	0.5
3	14 x 11	MS-2B	1
4	61 x 32	SS-1B, SS-2B, and SS-3B	1
4	40 x 32	SS-6B and SS-8B	1
4	20 x 32	SS-12B	1
5	41 x 32	SSC-1 and SSC-2	1
6	20 x 32	SS-2D	2

Table 3-8a contains the analytical results for the soil samples collected at each remediation location associated with Building 170. Figure 4-22 shows the locations of soil samples where PCBs were detected below the 1.0 ppm voluntary action level but remain above the ARAR. Aroclor 1260 concentrations from the 0 to 6 inch BGS interval samples at locations MS-3, MS-4, SS-4, SS-5, and SS-7; and those from the 24 to 30 inch BGS interval samples at locations SS-3, SS-6, and SS-8 exceed the ARAR. Interim measures for excavating and segregating soil for offsite disposal during construction of the DOT HQ building will include plans to excavate and remove soils from these voluntary removal areas that contain PCBs above respective ARARs.

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Asbestos-containing materials and lead-containing surface coatings are known to be currently present in and on Building 170. Any future use of this building must include measures to remove these materials or manage them in place.

Upon completion of the concrete slab removal from former Building 232, six soil samples were collected from 3 inches to 2 feet below the base of the former concrete slab. Analytical results indicated the PCB concentrations at two sampling locations were below the USEPA voluntary PCB spill clean-up level of 1 ppm, indicating that no further voluntary action was required at these locations. However, four soil sample locations contained a total PCB concentration in excess of 1 ppm. The GSA-NCR directed removal of an additional one foot thickness of soil from these areas. Following removal, a second round of soil samples were collected from these areas and analyzed for PCB content. Based on the second round of results, the soil was found to contain concentrations of total PCBs below 1 ppm. The following table outlines the extent and depths of interior soil excavations for Building 232.

Iteration	Area Excavated (feet north-south x feet east-west)	Sample Locations Covered in Area Excavated	Depth (feet)
1	57 x 45	SS-1, SS-2, SS-3, SS-4, SS-5, and SS-6	1
2	28 x 45 and 28 X 22	SS-1, SS-2, SS-3, and SS-5	1

Table 3-8a contains the final analytical results for the soil samples collected in former Building 232. Figure 4-22 shows the locations of the soil samples where PCB was detected below the 1.0 ppm voluntary action level but remain above the ARAR. All six PCB analytical results were reported as <1.0 mg/kg for each Aroclor analyzed. Based on this and the assumed detection limits, the concentrations of Aroclor 1260 remaining in the soil at these six locations are assumed to be above the ARAR. All of this soil will be removed as part of a USEPA approved interim measures plan for excavation, segregation, and offsite disposal of soil during construction of the DOT HQ building.

SECTION FIVE

Identification of Potential Receptors

Identification of potential receptors is not included in this RFI Report.

The CO and RFI Workplan specified that a Potential Receptors Identification be conducted and included in the RFI Report. As stated in the CO, a Potential Receptors Identification is "necessary to support the Risk Assessment." The purpose of conducting a Potential Receptors Identification is to collect data necessary to describe human populations and environmental systems that may be susceptible to exposure from contaminants present on a site.

On July 24, 2002, GSA-NCR, URS, and representatives of the site development team attended a meeting hosted by the USEPA in Philadelphia, Pennsylvania. The meeting was requested by the GSA. Meeting agenda items included, but were not limited to, updating USEPA on progress of the RFI, presenting the proposed development plan and schedule, and presenting recommendations regarding the RFI Report submittal and review schedule and risk assessment.

The GSA-NCR and URS proposed deferment of conducting the risk assessment. Conducting a baseline risk assessment before construction would not accurately characterize risks to human populations and environmental systems because a large portion of the impacted soil and groundwater would be removed from the DOT Parcel during foundation excavation. The risk assessment would more appropriately be a part of interim measures plans for construction of the DOT building. In an August 16, 2002 letter, the USEPA approved this approach to the risk assessment, provided health and safety measures are implemented during excavation to protect sensitive human populations (e.g., construction workers, SEFC workers and visitors, and the public) and environmental systems. The USEPA approved approach also dictates that soil risks posed by soil contaminants will be kept as separate assessments for the DOT Parcel and SEFC, but that the SEFC RFI shall include an assessment using all groundwater data (i.e. those from the DOT Parcel are included). In summary, since conducting a risk assessment was deferred and identification of receptors is part of the risk assessment, an Identification of Potential Receptors was not conducted.

A schematic design description dated July 10, 2002 indicates that the excavation will extend from about 50-feet south of M Street, S.E. in the north to about 40-feet north of Building 167 in the south and from Fourth Street, S.E. in the east to New Jersey Avenue, S.E. in the west, an area approximately 800 feet by 270 feet (Figure 2-3). The excavation reportedly will be approximately 25 to 30-feet deep. This equates to approximately 210,000 cy of soil to be removed and properly disposed offsite.

SECTION SIX

Risk Assessment

A complete RFI risk assessment is not included in this RFI Report.

The CO and RFI Workplan specified that a Risk Assessment be conducted and included in the RFI Report. The purpose of conducting a baseline risk assessment is to provide an analysis of potential adverse human health effects that may be caused by the impacted soil and groundwater present at the DOT Parcel assuming no actions are implemented to control or mitigate the contaminants.

On July 24, 2002, GSA-NCR, URS, and representatives of the site development team attended a meeting hosted by the USEPA in Philadelphia, Pennsylvania. The meeting was requested by the GSA. Meeting agenda items included, but were not limited to, updating USEPA on progress of the RFI, presenting the proposed development plan and schedule, and presenting recommendations regarding the RFI Report submittal and review schedule and risk assessment.

The GSA-NCR and URS proposed deferment of conducting the risk assessment. Conducting a baseline risk assessment before construction would not accurately characterize risks to human populations and environmental systems because a large portion of the impacted soil and groundwater would be removed from the DOT Parcel during foundation excavation. The risk assessment would more appropriately be a part of interim measures plans for construction of the DOT building. In an August 16, 2002 letter, the USEPA approved this approach to the risk assessment, provided health and safety measures are implemented during excavation to protect sensitive human populations (e.g., construction workers, SEFC workers and visitors, and the public) and environmental systems. The USEPA approved approach also dictates that soil risks posed by soil contaminants will be kept as separate assessments for the DOT Parcel and SEFC, but that the SEFC RFI shall include an assessment using all groundwater data (i.e. those from the DOT Parcel are included).

However, the USEPA did direct the GSA-NCR to include data comparisons in the RFI Report. One data comparison that was conducted is also a part of the risk assessment process. The data comparison performed is known as a Tier I risk assessment. In a Tier I risk assessment, contaminant concentrations detected in media sampled and analyzed are compared to human health and environmental system risk screening levels. In this RFI, groundwater data were compared to USEPA April 2, 2002 RBCs for tap water (adjusted for cumulative non-carcinogenic effects) and soil data were compared to USEPA April 2, 2002 RBCs for both industrial and residential uses (adjusted for cumulative non-carcinogenic effects), and SSLs under a default attenuation factor of 20. The results of the this type of comparison separate contaminants that may be of potential concern (those contaminants that are or may be present at concentrations equal to or above ARARs) from contaminants that are not of further concern (those contaminants that are or may be present at concentrations below ARARs).

A schematic design description dated July 10, 2002 indicates that the excavation will extend from about 50-feet south of M Street, S.E. in the north to about 40-feet north of Building 167 in the south and from Fourth Street, S.E. in the east to New Jersey Avenue, S.E. in the west, an area approximately 800 feet by 270 feet (Figure 2-3). The excavation reportedly will be approximately 25 to 30-feet deep. This equates to approximately 210,000 cy of soil to be removed and properly disposed offsite.

SECTION SEVEN

Investigation Derived Waste

Investigation derived wastes (IDWs) include liquids, sludges, sediments, soils, and solids generated as a result of conducting the RFI field investigations. All soil cuttings, drilling fluids, well development liquids, decontamination solids and liquids were contained and placed in roll-off containers, storage tanks, or 55-gallon drums. All IDWs have been characterized, transported, and disposed of in accordance with Section Nine of the FSP. The GSA-NCR has been designated as Generator of all IDWs and listed as the generator of all wastes on manifests and bills-of-lading. Prior to the start of work, the GSA-NCR designated a GSA-NCR site representative who reviewed, approved, and signed all waste manifests.

Clean Harbors of Baltimore, Inc. (Clean Harbors) provided two covered roll-off containers for soil cuttings and solid waste storage, and three polyethylene tanks for groundwater and decontamination fluids. A 21,000 gallon tank was also provided by BakerTanks for groundwater and decontamination fluids storage. These tanks and containers were also utilized for storing soil cuttings, liquids from groundwater sampling, and solid wastes produced as part of the investigation on the remaining 44 acres of the SEFC property.

The wastewater produced from the DOT Parcel pump test was stored in the BakerTank, which was emptied by Tri-County Industries (TCI) on July 30, 2002. Six of the 55-gallon drums removed August 7, 2002 contained soil cuttings, concrete, and decontamination solids and liquids from the installation and development of the three wells installed in July 2002 for the pump test (BC-MW18, BC-MW19, and BC-MW20). One drum contained the purged liquid from well G2-SB/MW03 where the PSH was detected. Other drums contained solid waste (including personal protection equipment (PPE) and groundwater sampling materials) produced from the second round of groundwater sampling. Three remaining drums were empty at the time they were removed from the DOT Parcel. These drums had contained development water from the wells installed for the pump test. This water was transferred into the BakerTank immediately after the wells were installed and developed.

All IDW disposal documentation and Manifests are included in Appendix M. The analytical results, provided by PSI, for the composite soil sample collected from the soil cuttings are also located in Appendix M. The results of waste characterization, as specified in the FSP and QAPP (full RCRA characteristics and PCB content) indicate all tested parameters were not detected above respective MDLs. Thus, the waste was characterized as non-hazardous for disposal purposes.

Clean Harbors removed the following materials from the DOT Parcel:

- April 24, 2002, 2,848 gallons of non-DOT regulated liquid and sludge.
- June 5, 2002, 4 tons of soil and trash.
- June 13, 2002, two loads of soil, totaling 21 tons.

TCI removed the following material from the DOT Parcel:

- July 30, 2002, four loads of liquid, totaling 14,000 gallons and one load containing 1,900 gallons of liquid (30%) and sludge (70%).
- August 7, 2002, twelve 55-gallon drums containing liquid, soil, concrete, decontamination waste, and solid waste and three empty drums.

SECTION EIGHT

RFI Health and Safety

The RFI Health and Safety Plan (HSP), reviewed and accepted by the USEPA, was finalized by URS in April 2001. The HSP covers work that could potentially be conducted on any part of the SEFC property. However, it does not provide for worker protection in confined spaces or in places with limited egress.

Personnel, including URS staff and contractors, working within the exclusion zone as well as those monitoring the progress of the project outside of the exclusion zone, including GSA-NCR oversight personnel, were required to read the HSP and sign a sheet confirming that they had read the document and understood the potential hazards on the DOT Parcel and the safety precautions that may be necessary to avoid injury. Personnel were also introduced to the HSP requirements with a site safety briefing conducted by the project field manager/site safety officer. Afterward, each attendee signed a sheet to verify they had attended the briefing and understood the nature of the conditions on the DOT Parcel. All personnel working in the exclusion zone on the project site had completed a 40-hour OSHA Hazardous Waste Site Operations (HAZWOPER) training course and were up-to-date with any required 8-hour refresher classes and medical clearances.

During January 2002, 19 soil borings were drilled, 10 borings were finished as groundwater monitoring wells, and two additional groundwater monitoring wells were installed. Each of the 12 wells were developed after installation. Following development all wells were allowed to stabilize and equilibrate so representative groundwater samples could be collected. URS conducted the first round of groundwater sampling at the end of January 2002. In mid-March, another three soil borings were installed and groundwater monitoring wells were installed and developed at each boring location. A second round of groundwater sampling was conducted in late March 2002. There were no reportable injuries to personnel working within the exclusion zone or overseeing the progress of the work throughout the course of the above mentioned activities.

Three additional groundwater monitoring wells were installed in order to conduct the pump test in July 2002. On the second day of drilling, the driller received a minor cut from a metal tape measure. The incident report can be found in Appendix N. After the incident, the driller reported that the cut was similar to a paper cut and returned to work.

Health and Safety Air Monitoring Logs for the RFI can be found in Appendix N. Air monitoring was conducted using a photo-ionization detector (PID) at each of the soil boring locations. At a minimum, the PID was calibrated each morning before commencing drilling activities. Appendix E contains the calibration logs for instruments used during the course of the RFI. The PID did not register readings that were at or above Action Levels specified in the RFI HSP. Background PID readings and readings taken within the breathing zone were rarely above 0.0 ppm.

SECTION NINE

Summary of Findings

Based on the investigations conducted in accordance with the USEPA approved RFI Workplan, as modified by USEPA approved actions described in Section 3.1 of this report, and previous investigations conducted and documented in the DCC & IM/SS, the following findings are relevant to the environmental quality of soils and groundwater within the DOT Parcel, within the specific data-use limits described in Section 3:

9.1 HYDROGEOLOGY

- The site is underlain by at least two distinct water-bearing zones separated from each other by a continuous low-permeability layer (aquiclude) that acts as a barrier to the migration of groundwater contaminants from the shallow groundwater zone (depths from 10- to 40-feet BGS) into the deep groundwater zone (depths greater than 45-feet BGS).
- The shallow water-bearing zone is under water-table conditions and the deep (lower) water-bearing zone is under confined and artesian conditions within the limits of the DOT Parcel.
- Both the upper (shallow) water-bearing zone and lower (deep) water-bearing zone currently flow in a westerly direction. The expected flow direction, based on hydrogeologic principles in the absence of human influences, would be to the south towards the Anacostia River. The current flow direction is most likely influenced by dewatering of a subway station northwest of the site and the combined sewers under the western portion of the DOT Parcel. Previous investigations documented in the DCC & IM/SS concluded that the upper water-bearing zone flow direction was to the south-southwest up to at least 1996.
- Data do not support the hypothesis that the 80- to 110- feet deep “shrinkage pit” associated with former Building 153 is acting, or has acted, as a migratory pathway for contaminants from the upper (shallow) water-bearing zone to the lower (deep) water-bearing zone.
- The Darcy velocity (apparent groundwater velocity) for the shallow groundwater zone is in the range of 1.1×10^{-6} cm/sec (0.003 ft/day or 1 ft/year) and 4.9×10^{-6} cm/sec (0.014 ft/day or 5 ft/year) using data and information collected during the RFI related to testing the properties of the saturated deposits beneath the site. The Darcy velocity for the deep groundwater zone is estimated to be 7.1×10^{-7} cm/sec (0.002 ft/day or 0.8 ft/year) based data and information collected during the RFI related to testing the properties of the saturated deposits beneath the site.

SECTION NINE

Summary of Findings

9.2 DATA-GENERAL

- The figures and tables included in this report displaying constituent concentrations that exceed ARARs, are predominated by those that were not detected above analytical MDLs. These concentrations were displayed because the RCRA specified analytical methods, in some cases, are not able to achieve detection limits at, or lower than, ARARs. However, as a conservative approach, they these data were retained for comparison and presentation purposes. A decision should be made by risk assessment professionals regarding whether to retain any, or all, of these data points for inclusion in any future baseline numeric risk assessment.

9.3 METALS IN SOIL

- Aluminum, Arsenic, Barium, Chromium, Iron, Manganese, Nickel, Selenium, Silver, Thallium, and Vanadium were the only metal analytes detected in soil at concentrations equal to, or in excess of, respective ARARs.
- Arsenic is the most prevalent constituent (of metals, VOCs, SVOCs, and PCBs) detected in soil across the site. However, it is well documented that ARAR for Arsenic is less than the naturally occurring concentration of Arsenic in many areas of the U.S., including the area in which the DOT Parcel is located. Also, Arsenic ARAR exceedances were present in terrace deposit and Potomac Group soil samples (deposits pre-dating human evolution) which further supports the conclusion that the Arsenic is naturally occurring.
- Aluminum, Barium, Chromium, Iron, Manganese, and Vanadium concentrations at or above respective ARARs were detected in fill material samples (human-influenced), and in terrace deposit and Potomac Group soils. Therefore, these constituents are also most likely naturally occurring variations since some of the deposits where they were detected pre-date human evolution.
- The Nickel and Silver exceedances were in the shallow soil sample (2- to 4- feet BGS) at one location, BC-SB/MW08. Soil in this general area will be excavated and disposed of offsite down to a depth of at least 20-feet BGS in the coming 12-months as construction on the DOT Parcel progresses. Thus, this soil ARAR exceedance will be removed from the Site.
- The Vanadium exceedance was in the deep sample (12- to 14-feet BGS) at one location, K&D09. Soil in this general area is not planned to be excavated to a depth that would intercept the exceedance depth interval. However, in the coming 12-months construction on the DOT Parcel will have commenced. The development plans for the ground surface above this area include installation of a roadway, curbs, and sidewalks. Therefore, this soil ARAR exceedance will be isolated from possible human contact.

SECTION NINE

Summary of Findings

9.4 VOLATILES IN SOIL

- Acetone, Acetonitrile, Benzene, Chloroform, 1,4-Dichlorobenzene, Ethylbenzene, Methylene Chloride, 1,1,1,2-Tetrachloroethane, and Toluene were the only VOCs detected at or above respective soil ARARs. The Acetone exceedances are attributable to laboratory contamination (as determined by validation of RFI data). The Methylene Chloride exceedances are also attributed to laboratory contamination although they only occurred in historic data that were not validated. Please see the discussion concerning laboratory contaminants in Section 4.2.1.3 of this report.
- Acetonitrile was detected at three widely-spaced and isolated locations across the DOT Parcel. Exceedances were reported in samples from fill materials, terrace deposits, and Potomac Group deposits. Therefore, the exceedances are most likely to be artifacts of the RFI investigation process (well screen/casing plasticizers, drilling mud ingredients).
- Chloroform was only detected above its ARAR in the deepest sample collected in the DOT Parcel, the 105- to 107-foot BGS sample from location MW05. Therefore, it is most likely to have been introduced by the RFI investigation process (municipal water used to mix drilling mud).
- The detections of the five remaining exceedances do not occur in the shallowest sample collected at each location but instead coincide with the approximate depth of the water-table (approximately 15- to 22-feet BGS) or probable “smear-zone” above the water table (approximately 10- to 15-feet BGS). This indicates that the soil was impacted by contaminants dissolved or contained in the shallow groundwater zone.
- Benzene ARAR exceedances were detected at three locations within the historic petroleum hydrocarbon groundwater plume: BC-MW02, BC-SB/MW05, and K&D18. Ethylbenzene was also detected above its ARAR at location BC-MW02. The contaminated groundwater plume, and hence the ARAR exceedances, is believed to have originated from the offsite service station location, north of the DOT Parcel across M Street, S.E.
- Benzene ARAR exceedances were also detected at the northeast corner of former Building 216, at locations BC-SB/MW07 and BE-SB03. Toluene and Ethylbenzene ARAR exceedances were also detected in soil at BC-SB03. Further, one Ethylbenzene exceedance was detected in soil from location K&D18. These exceedances are most likely related to the former presence of USTs (now removed) at the northeast corner of former Building 216.
- 1,1,1,2-Tetrachloroethane ARAR exceedance was detected at only one sample location and only at depths ranging from 15- to 22- feet BGS. The sample location is within the “footprint” of a former building where vehicle maintenance was once conducted (former Building 216). It is also adjacent to, and in close proximity to, the location of two USTs that were removed (UST Nos. 4 and 5).

SECTION NINE

Summary of Findings

- 1,4-Dichlorobenzene ARAR exceedance was detected only at the sample location where PSH was detected and in only the 10- to 12-foot BGS sample interval. This compound is likely related to a leaking municipal sewage pipe since the compound is commonly associated with moth balls, sewage, and toilet bowl deodorizers.

9.5 SEMIVOLATILES IN SOIL

- Benzo (a) anthracene (BAA), Benzo (b) fluoranthene (BBF), Benzo (a) pyrene (BAP), Dibenzo (a,h) anthracene (DAHA), 1,4-Dichlorobenzene (also an AP IX VC target compound), Naphthalene, and Nitrobenzene were the only SVOCs detected at concentrations above ARARs. All exceedances were in shallow samples, being at 7-foot BGS or less, with the exception of the Nitrobenzene exceedance in the 25- to 27-foot BGS sample from location BE-SB03.
- BAP, BBF, and DAHA ARAR exceedances were detected at depths less than 7-foot BGS in the northeast corner of former Building 216, near the locations of USTs that were removed (UST Nos. 4 and 5). BAP, DAHA, and Naphthalene ARAR exceedances were also detected along the western side of former Building 216. One BAP ARAR exceedance was detected in the vicinity of the former location of aboveground motor oil storage tanks at the eastern side of former Building 216. All of these exceedances are most likely related to the vehicle maintenance activities once conducted in former Building 216. Another likely possibility as to their origin may be the human-placed fill in this area.
- The Nitrobenzene detected at one location along the western side of former Building 216 (along with BAP, DAHA, and Naphthalene) is likely a photo-oxidation product of Pyrenes and Naphthalenes. 1,4-Dichlorobenzene was also detected at this location (SB116) and is likely related to the vehicle maintenance activities once conducted in former Building 216.
- The sole ARAR exceedance in deep soil, Nitrobenzene in the 25- to 27-foot BGS sample from location BE-SB03, is difficult to ascribe to a particular source or historic activity.
- BAP was detected at the northeastern corner of former Building 153. BAA, BAP, BBF, DAHA, and Naphthalene were detected near the center of former Building 153. Since these compounds were not detected above ARARs at other locations within the location of former Building 153, the most likely origin is the human placed fills in this area. However, the likelihood that industrial activities associated with former Building 153 cannot be discounted.
- The remaining detections were at two locations at the south-central border of the DOT Parcel (K&D14 and K&D20). BAP was detected and is likely attributable to general industrial activities once conducted at the site and/or having originated from the human-placed fills in the area.

SECTION NINE

Summary of Findings

9.6 PCBs IN SOIL AND SEDIMENT

- Aroclor 1260 was the only target compound PCB detected within the DOT Parcel. The detections exceeded the soil ARAR for this compound.
- Of the six stormwater catchment structures sampled, sediment in only three of them contained PCB concentrations at or above the ARAR. The Aroclor 1260 detection at location BC-SD12 was in a catchment structure adjacent to Building 170, where a significant voluntary PCB removal action was completed. The downstream stormwater conveyance locations, BC-SD14 and BC-SD16, did not contain Aroclor 1260 in sediment concentrations at or above the ARAR. The detection at location BC-SD17 was in a catchment structure adjacent to former Building 232, where another significant voluntary PCB removal action was completed. The downstream stormwater conveyance location, BC-SD15, contained an Aroclor 1260 in sediment concentration of 0.40 which is 0.08 ppm above the ARAR. These two stormwater conveyance systems containing Aroclor 1260 in sediment ARAR exceedances has been cleaned under a USEPA approved IM. A report documenting the cleaning activities is scheduled to be issued to the USEPA for review and approval in the Spring of 2004.
- Soil samples collected within the location of former Building 153 and the adjacent former Crane Area 263 contained Aroclor 1260 concentrations above the ARAR at only three widely-spaced areas - at the southeastern corner (AOI-G1), at the approximate center of the former building (locations BC-SB/MW05 and K&D19), and at the eastern end of former Crane Area 268 (location BC-SB/MW08). The detections in the former crane area and at the approximate center of the former building are at shallow depths (no more than 4-feet BGS). The detections at G1-SB02 extend to a depth of up to 12-feet BGS. All three of these exceedance areas will be excavated and disposed of offsite down to a depth of at least 20-feet BGS in the coming 12-months as construction on the DOT Parcel progresses. Thus, these soil ARAR exceedances will be removed from the Site.
- One additional location where Aroclor 1260 was detected above the ARAR is at the north end of former Building 216 (K&D08). The exceedance extends down to 13-feet BGS. This isolated area of Aroclor impact to soil is likely related to activities once conducted in former Building 216. However, in the coming 12-months construction on the DOT Parcel will have commenced. The development plans for the ground surface above this area include installation of a roadway, curbs, and sidewalks. Therefore, this soil ARAR exceedance will be isolated from possible human contact.
- Although voluntary removals of PCB-contaminated floor slabs and soil beneath the floor slabs was conducted and remaining PCB concentrations in soil are below 1 ppm (the USEPA TSCA PCB spill voluntary soil clean-up standard), Aroclor 1260 remains in soil at concentrations above the ARAR. The two voluntary removal actions were conducted at former Building 232 and Building 170. The USEPA approved IM for soil removal during construction on the DOT Parcel specifies removal of the Aroclor 1260 exceedances and confirmation that remaining concentrations in soil at below applicable ARARs.

SECTION NINE

Summary of Findings

9.7 UNCONFINED SHALLOW GROUNDWATER

- Arsenic, Barium, and Thallium were the only AP IX ICs detected above respective ARARs in shallow groundwater zone samples within the DOT Parcel. All of the exceedances were at isolated locations and singular in nature. It is difficult to speculate as to their possible source, other than being derived from adjacent soils. For instance Barium was detected in soil above the ARAR at one groundwater exceedance location but was detected in soil below the ARAR at the three other groundwater exceedance locations. These exceedances were only detected in samples from two of the 14 shallow groundwater zone wells. Therefore, the exceedances are not likely an indicator of overall or gross groundwater quality degradation but may be related to natural variances.
- Benzene, Chloroform, 1,4-Dichlorobenzene, Ethylbenzene, MTBE, Toluene, Trichloroethene, and total Xylenes were the only AP IX VCs detected at or above groundwater ARARs in shallow zone groundwater within the DOT Parcel.
- Benzene and Ethylbenzene exceedances were present in groundwater at locations BC-MW02, BC-MW06, MW03, and MW13. Toluene and total Xylenes were also detected above respective ARARs in groundwater at location BC-MW02. Napthalene (an AP IX SVC compound) was also detected in groundwater above its ARAR in samples from the same three wells. All five of these COCs, when found together, represent petroleum hydrocarbon related contamination. All three wells are located historically-downgradient of the offsite former service station located north of the site that has a documented release of petroleum products. These wells are also within the historic petroleum hydrocarbon contaminant plume in the shallow groundwater zone. Therefore, the most likely source of groundwater contamination detected in these monitoring wells is the offsite former service station located north of the property on the northwest corner of 3rd and M Streets S.E.
- Chloroform was detected above the groundwater ARAR at locations BC-MW02, BC-SB/MW08, and G2 SB/MW03. Chloroform, a common laboratory contaminant, is also associated with industrial solvents as a production by-product and as an indicator of chlorinated drinking water. The exceedance at location BC-MW02 may be an indicator of past industrial processes but other chlorinated VOCs were not detected in soil or groundwater at or near this location. Exceedances at locations BC-SB/MW08 and G2 SB/MW03 are most likely due to leaking domestic water pipes.
- 1,4-Dichlorobenzene was detected above its groundwater ARAR at location G2-SB/MW06. Based on the presence of 1,4-Dichlorobenzene (a chemical associated with raw sewage, moth balls, and toilet bowl deodorizers) in nearby groundwater, the Chloroform and 1,4-Dichlorobenzene ARAR exceedances in the shallow groundwater zone of AOI-G is most likely due to a leaking domestic water supply pipe.

SECTION NINE

Summary of Findings

- TCE was detected above the groundwater ARAR at only one of 14 shallow groundwater zone monitoring locations, BE-SB/MW02. TCE impact may be due to the use of industrial solvents for parts cleaning and metal degreasing that may have been conducted in former Building 216. Its extent in groundwater is likely localized in nature.
- MTBE was detected above its groundwater ARAR at only one of 14 shallow groundwater zone monitoring locations, BE-SB/MW04. The detection of MTBE, a gasoline additive, in the shallow groundwater zone at BE-SB/MW04 may be due to the vehicle maintenance and storage activities performed in former Building 216, the former USTs at the northeast corner of former Building 216, or possibly, but less likely, from the offsite former service station. However, its extent in groundwater is likely localized in nature.
- Bis (2-ethylhexyl) Phthalate, 2-Methylnaphthalene, and Naphthalene were the only AP IX SVCs detected above groundwater ARARs in shallow groundwater zone samples. Bis (2-ethylhexyl) Phthalate was at location MW03; Naphthalene at locations BC-MW02, MW03, and MW13; and 2-Methylnaphthalene at locations BC-MW02 and MW13. These ARAR exceedances are likely related to the petroleum hydrocarbon contaminant plume believed to have originated from the offsite former service station property across M Street, S.E.

9.8 CONFINED, ARTESIAN DEEP GROUNDWATER

- Barium was the only AP IX IC detected in deep groundwater zone samples at or above applicable ARARs. This constituent was detected in both samples collected from well BC-SB/MW01. Barium was also detected at concentrations above the soil ARAR in all samples collected during the drilling of this well. The soil samples represent fill material, terrace deposits, and Potomac Group deposits. Therefore, the Barium exceedance is most likely due to the presence of naturally occurring Barium in soils around the well.
- MTBE was the only AP IX VC detected in deep groundwater zone samples at or above applicable ARARs. This constituent was detected only in the first round sample collected from well BC-SB/MW01. The concentration detected represents only a 12% exceedance of the ARAR. The MTBE detection is difficult to attribute to a likely or suspected source since it was not detected in the shallow groundwater zone above the aquitard and was not detected in soil at or near the location of BC-SB/MW01.
- Bis (2-ethylhexyl) Phthalate was the only AP IX SVC detected in deep groundwater zone samples at or above applicable ARARs. This constituent was detected only in the first round sample collected from well BC-SB/MW05. Its presence may be due to local groundwater chemistry acting upon the PVC well materials or possibly be a laboratory contaminant (although the laboratory and data validation effort did not qualify these detections as laboratory contaminants).

SECTION TEN

Limitations

The GSA-NCR Order for Supplies and Services under Contract Number GS10F0105K to conduct the RFI and prepare this report is not a personal service contract and representatives of the GSA-NCR were not authorized and did not supervise URS personnel. However, non-supervisory direction and guidance from GSA-NCR officials was authorized and offered. URS performed all work as an independent contractor and not as an agent or employee of the GSA-NCR.

No warranty or guarantee, either expressed or implied, concerning data and information presented or findings, interpretations, or conclusions presented in this report is offered or intended. Rather, it is represented that the scope of performance of the professional services rendered is in accordance with the current state of practice as conducted within the region by similarly qualified practitioners. Further, URS cannot be held responsible for the judgment or attitudes of USEPA or District of Columbia regulatory officials with respect to application of regulatory criteria; acceptance of findings, judgments, interpretation, and conclusions; or application of screening criteria, contaminant standards, or clean-up (remediation) to the DOT Parcel or to a particular portion of the site.

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SECTION TWELVE

List of Acronyms

AL	Action Level
AOI	Area of Investigation
AP IX IC	Appendix IX Inorganics (excluding Cyanide and Sulfide)
AP IX OP	Appendix IX Organochlorine Pesticides (Aroclors only)
AP IX SVC	Appendix IX Semivolatiles
AP IX VC	Appendix IX Volatiles plus Methyl tert-butyl ether
Apex	Apex Environmental, Inc.
ARAR	Applicable or Relevant and Appropriate Requirements
As	Arsenic
AST	Above Ground Storage Tank
B(a)A	Benzo(a)anthracene
B(a)P	Benzo(a) pyrene
Ba	Barium
BCIE	bis(2-chloroisopropyl)ether
BGS	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
Cd	Cadmium
CLP	Contract Laboratory Program
CO	Consent Order
COC	Constituents of Concern
CRP	Community Relations Plan
Cu	Copper
D.C.	District of Columbia
DCC&IM/SS	Description of Current Conditions and Summary of Interim Measures/Site Stabilization
DC-DOH	District of Columbia Department of Health
DCQAP	Data Collection Quality Assurance Plan
DMP	Data Management Plan
DOT	U.S. Department of Transportation
DRO	Diesel Range Organics
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment

SECTION TWELVE

List of Acronyms

°F	Fahrenheit
FSP	Field Sampling Plan
ft/min	Feet per Minute
GPM	Gallons per Minute
GRO	Gasoline Range Organics
GSA-NCR	U.S. General Services Administration National Capital Region
Hg	Mercury
HSP	Health and Safety Plan
IDW	Investigation Derived Waste
k	Hydraulic Conductivity
K&D	Kaselaan & D'Angelo Associates, Inc.
MDL	Method Detection Limits
MSL	Mean Sea Level
µg/L	Microgram per Liter
µg/kg	Micrograms per kilogram
mg/kg	Milligram per Kilogram
mg/L	Milligram per Liter
MTBE	Meth-tert-butyl-ether
NGVD	National Geodetic Vertical Datum
Ni	Nickel
NPDES	National Pollutant Discharge Elimination System
PAH	Polynuclear Aromatic Hydrocarbon
Pb	Lead
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PMP	Project Management Plan
ppb	Parts Per Billion
ppm	Parts Per Million
PSH	Phase Separated Hydrocarbon
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RBC	USEPA Region III Risk-Based Concentrations

SECTION TWELVE

List of Acronyms

RCRA	Resource Conservation and Recover Act
RFI	RCRA Facility Investigation
RL	Reporting limits
S.E.	Southeast
Se	Selenium
SEFC	Southeast Federal Center
SI	Use History and Proposed Investigation of Previously Undocumented Buildings and Areas
SSL	USEPA Region III Soil Screening Level
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethene
TCI	Tri County Industries, Inc.
TCL	Target Compound List
TCLP	Toxicity Characterization Leaching Procedure
TPH	Total Petroleum Hydrocarbon
URS	URS Group, Inc.
USEPA	U.S. Environmental Protection Agency - Region III
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WCFS	Woodward-Clyde Federal Services
WNY	Washington Navy Yard